Fig 1
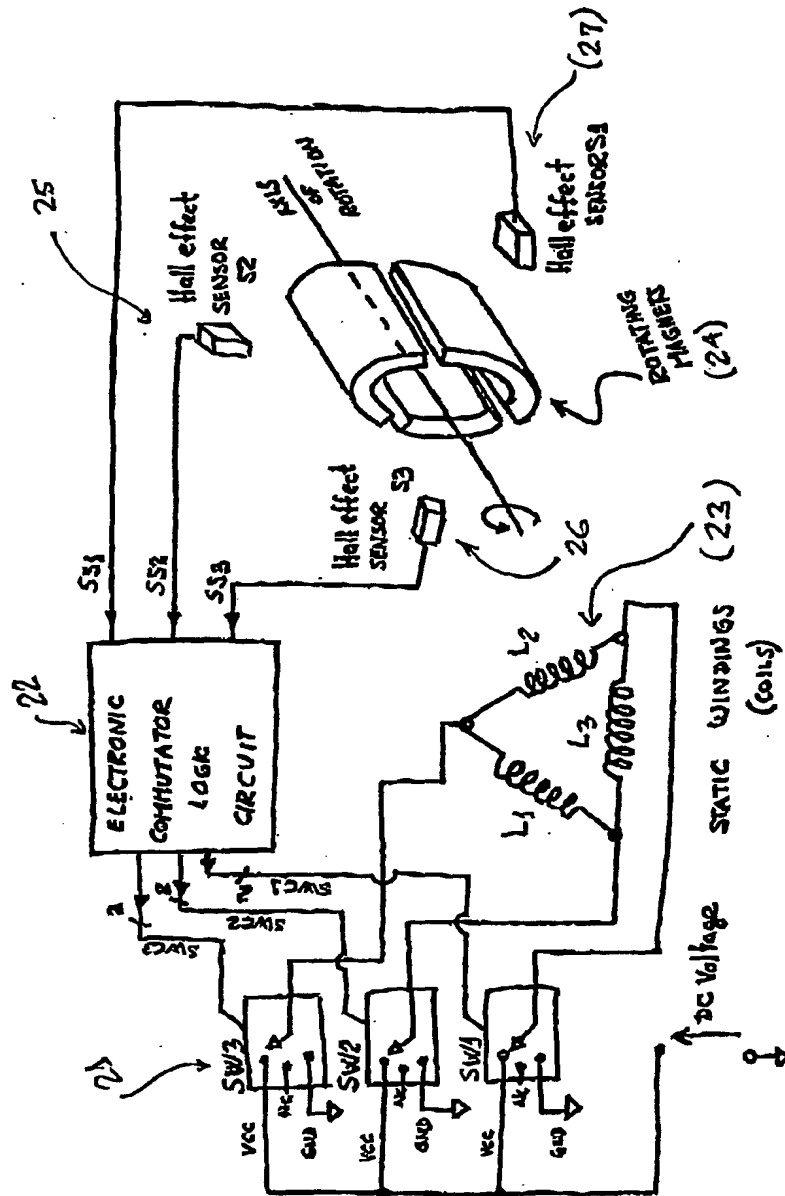
Fig 2

Permanet magnet brushless DC motor
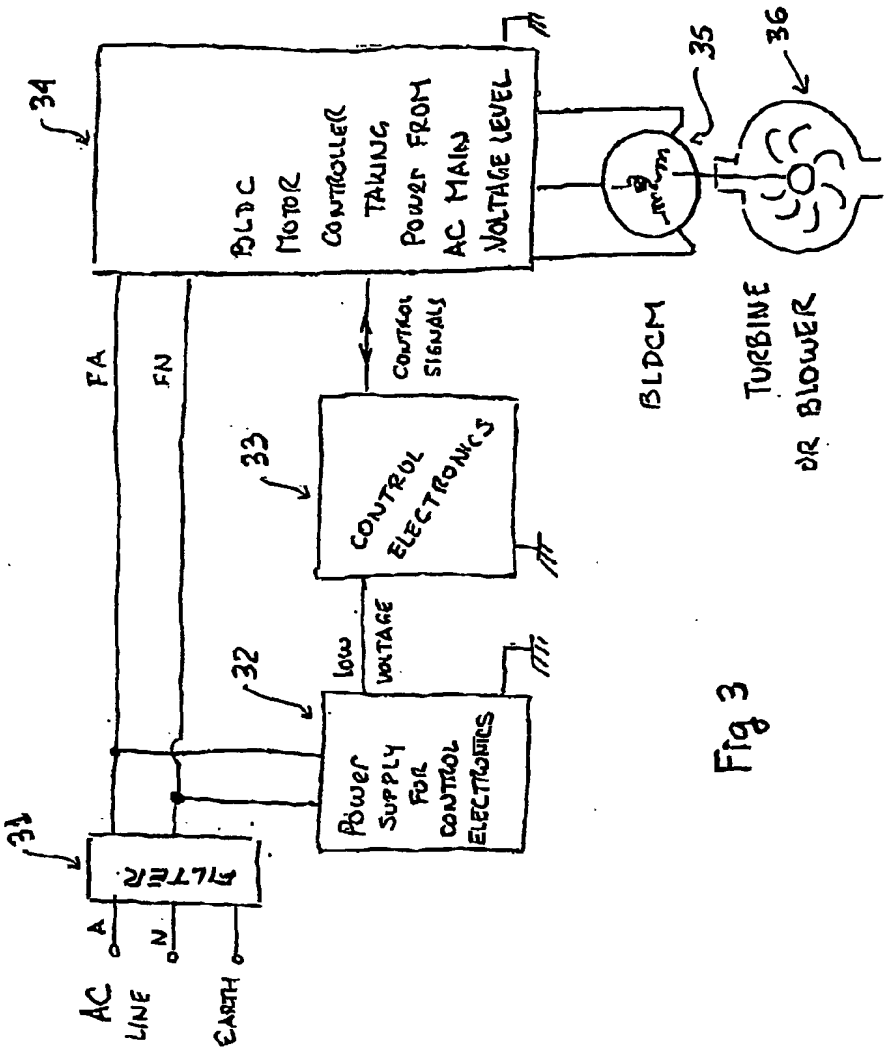
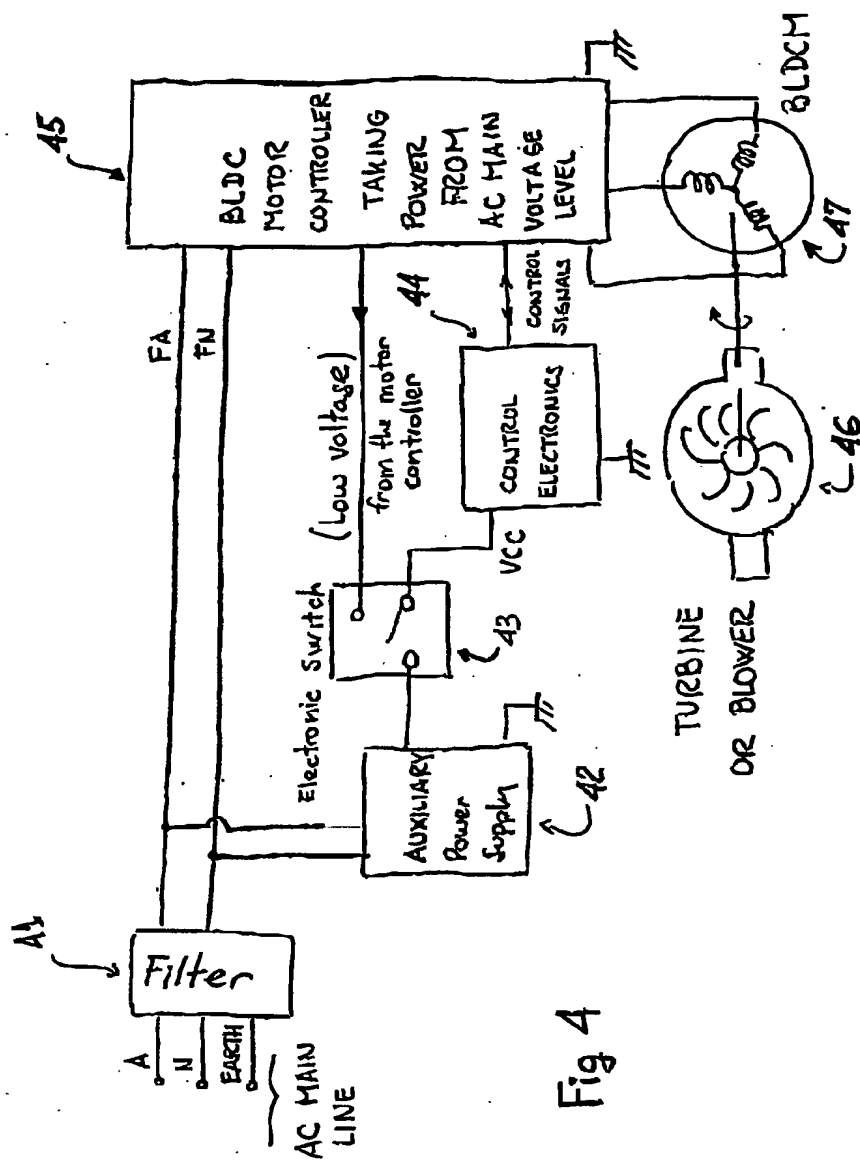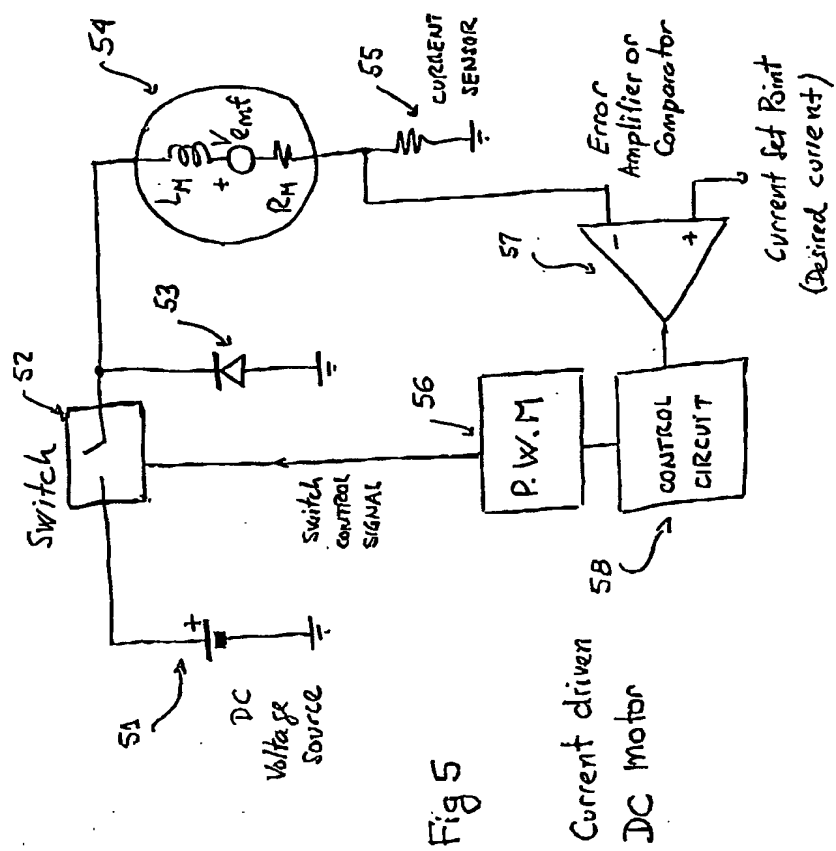34 BLDC MOTOR CONTROLLER TAKING POWER FROM AC MAIN VOLTAGE LEVEL

FA

FN

CONTROL SIGNALS

33 CONTROL ELECTRONICS

LOW VOLTAGE

32 POWER SUPPLY FOR CONTROL ELECTRONICS

31 FILTER

A
AC LINE
N
EARTH

35 BLDCM

36 TURBINE OR BLOWER

Fig 3

Fig 4

Fig 5

Current driven DC motor
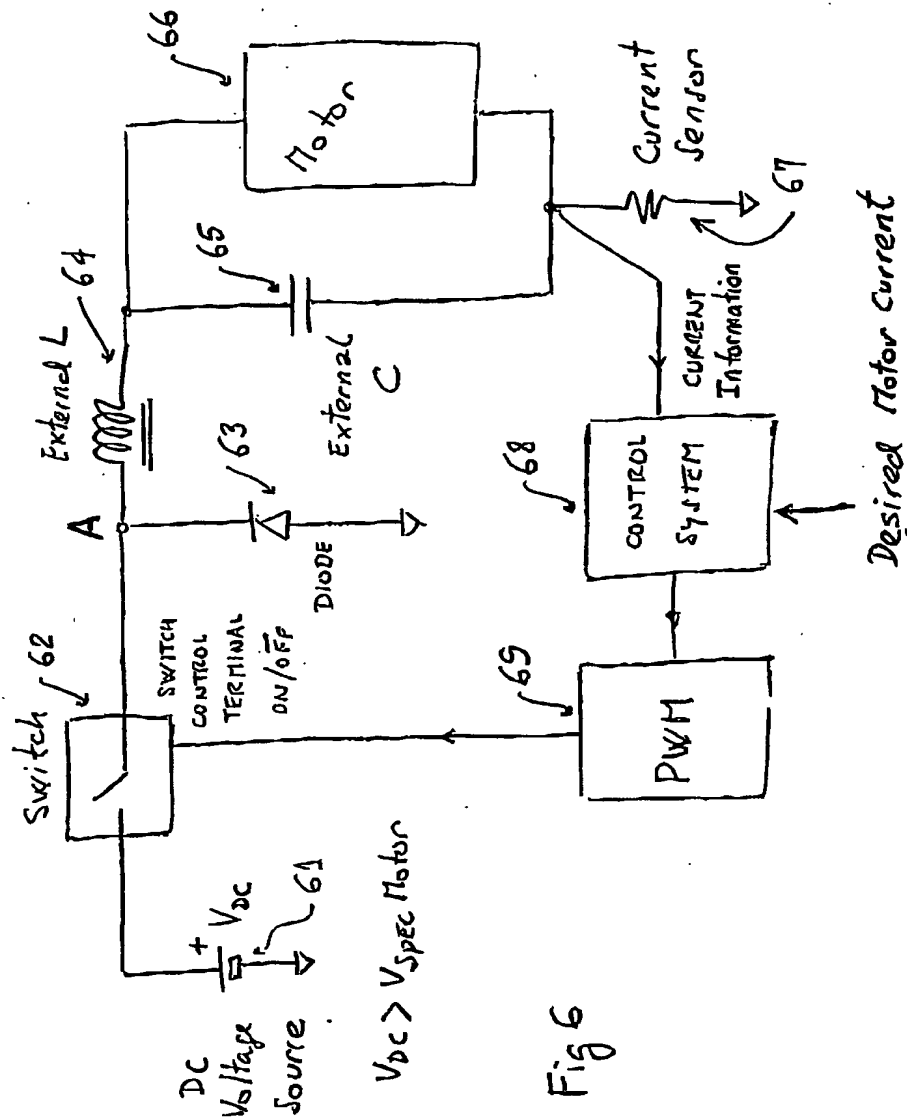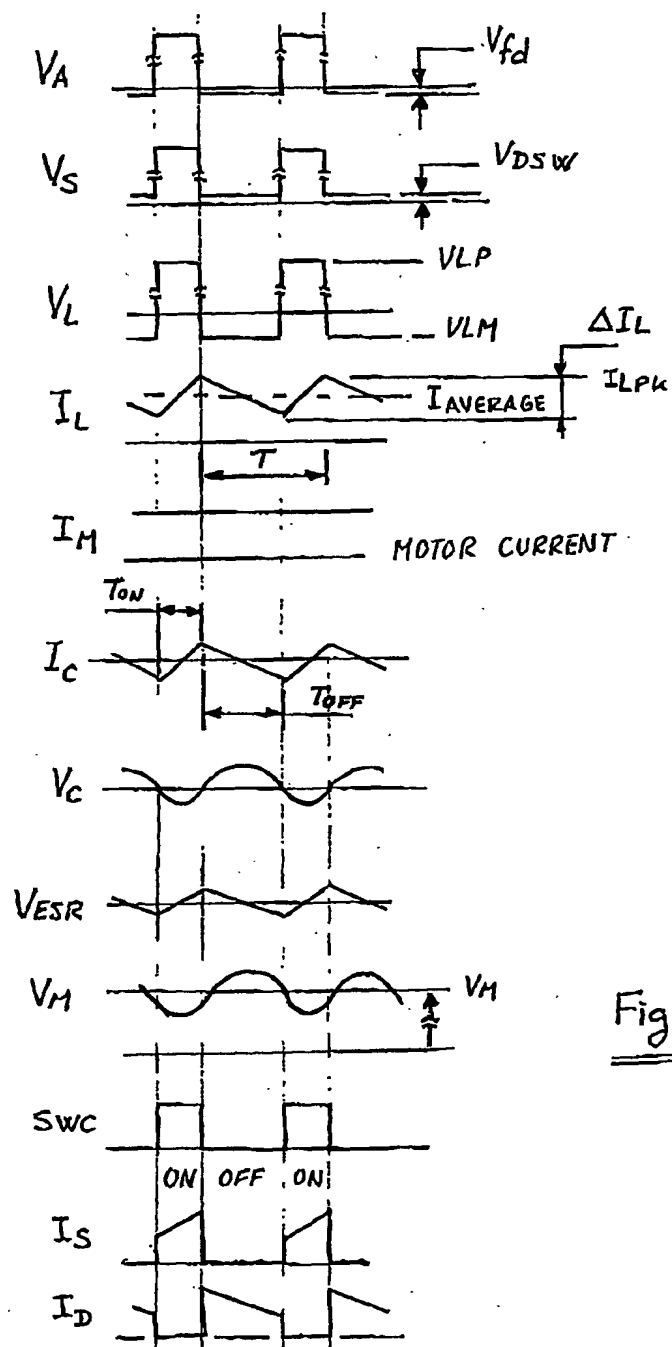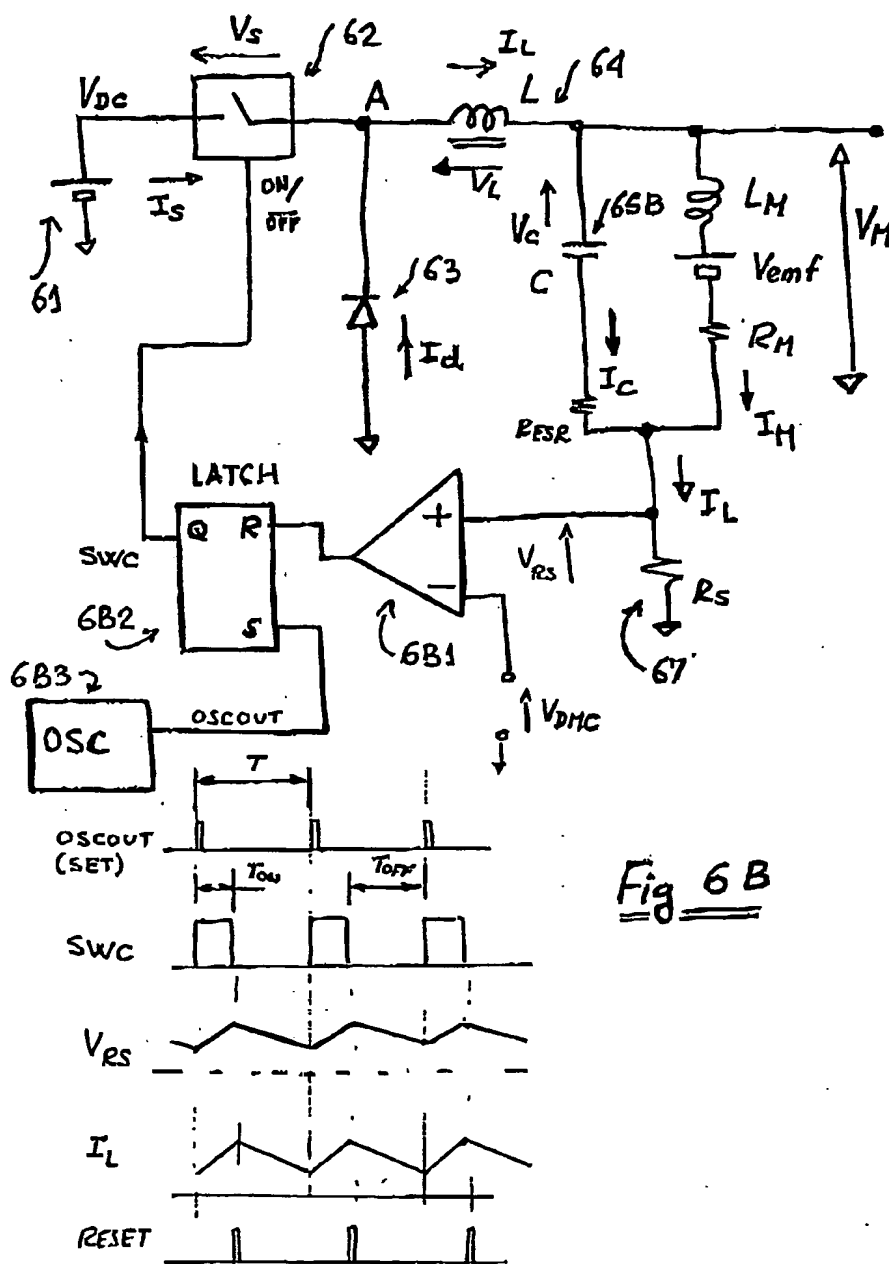
Fig 6

Fig. 6A

Fig 6B

1) $V_S = V_{DC} - V_A$

2) $V_L = V_A - V_M$

3) $V_M \cong I_M R_M + V_{emf}$

4) $V_{emf} = k_v \omega_M$

5) $I_S = I_L$

6) $I_L = I_C + I_M$

7) $I_L = V_{RS}/R_S$

8) $V_M = V_C + I_C R_{ESR}$

9) $T = T_{ON} + T_{OFF}$

10) $I_L = I_{AVERAGE} + I_L(t)$

11) $I_{LPk} = I_{AVERAGE} + \Delta I_L/2$

12) $I_{LMIN} = I_{AVERAGE} - \Delta I_L/2$

13) $I_M = I_{AVERAGE}$

14) $I_C = I_L(t)$

15) $I_L(t) = \frac{1}{L} \int V_L(t)\, dt$

16) $I_L = \frac{V_L}{L} t = \frac{V_A - V_M}{L} t$
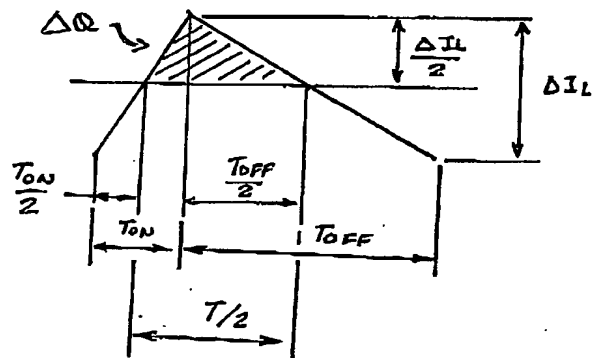
17) $I_L = \frac{V_{DC} - V_S - V_M}{L} t$

$\underline{Fig\ 6C\text{-}1}$

18) $\Delta I_L = \dfrac{V_{DC} - V_S - V_\Pi}{L} \, T_{ON}$ Fig 6C-2

19) $|\Delta I_L| = \dfrac{V_\Pi + V_{fd}}{L} \, T_{OFF}$

20) $\dfrac{V_{DC} - V_S - V_\Pi}{L} \, T_{ON} = \dfrac{V_\Pi + V_{fd}}{L} \, T_{OFF}$

21) $\left(V_{DC} - V_\Pi \right) T_{ON} \cong V_\Pi \, T_{OFF}$

22) $V_\Pi \cong V_{DC} \dfrac{T_{ON}}{T_{ON} + T_{OFF}} = V_{DC} \dfrac{T_{ON}}{T}$

23) $\Delta Q = \dfrac{1}{2} \cdot \dfrac{T}{2} \cdot \dfrac{\Delta I_L}{2}$

24) $\Delta V_{C_C} = \dfrac{\Delta Q}{C} = \dfrac{\Delta I_L}{f \, 8 \, C}$

25) $\Delta V_C = \Delta V_{CC} + \Delta I_L \, R_{ESR}$

26) $\Delta V_C \ll V_\Pi$

Fig 7A
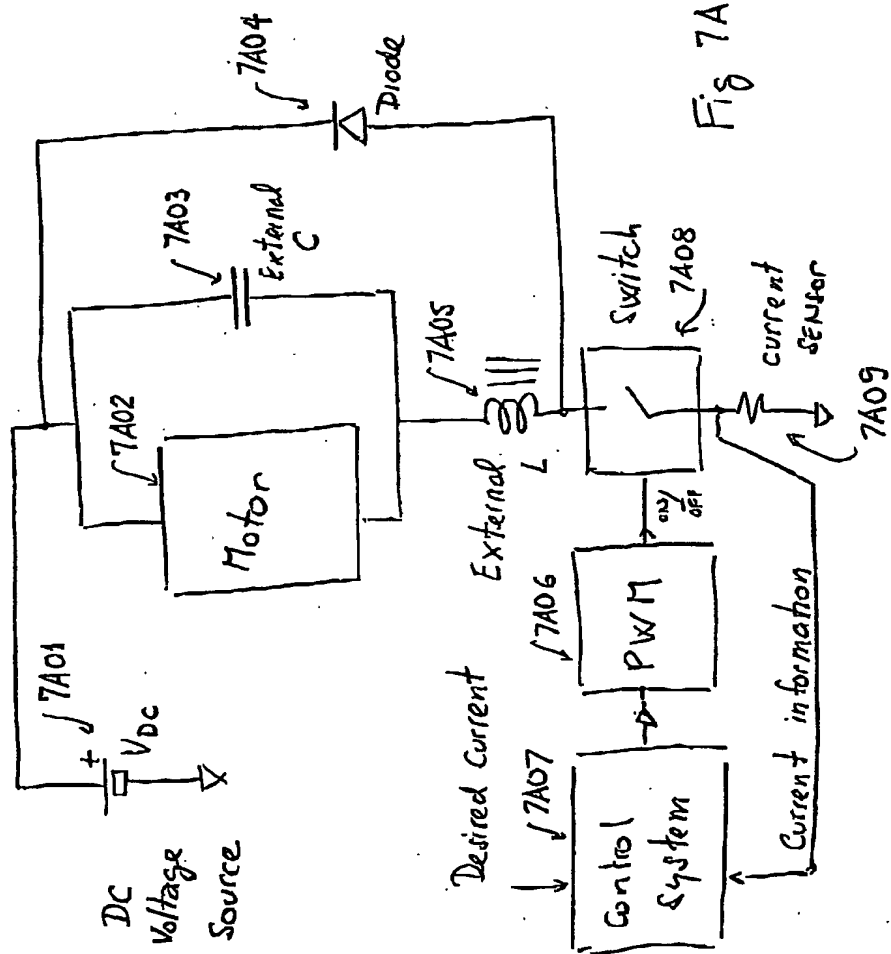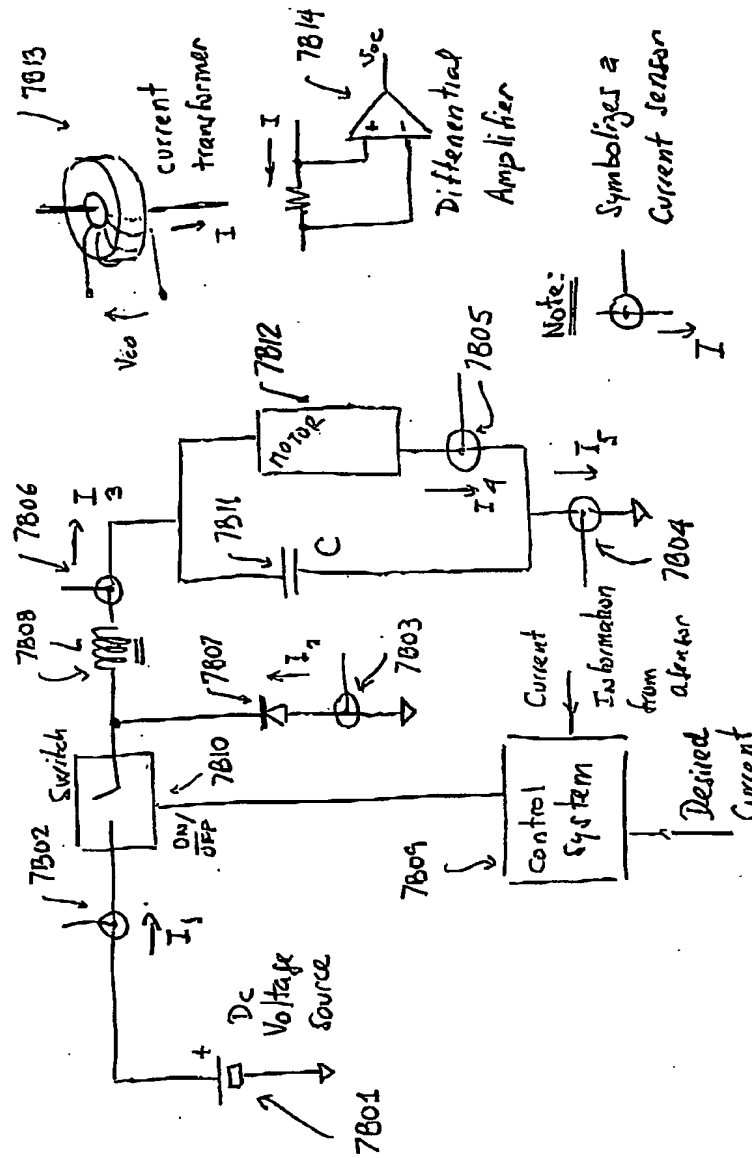
Fig 7B

Positions of current sensors
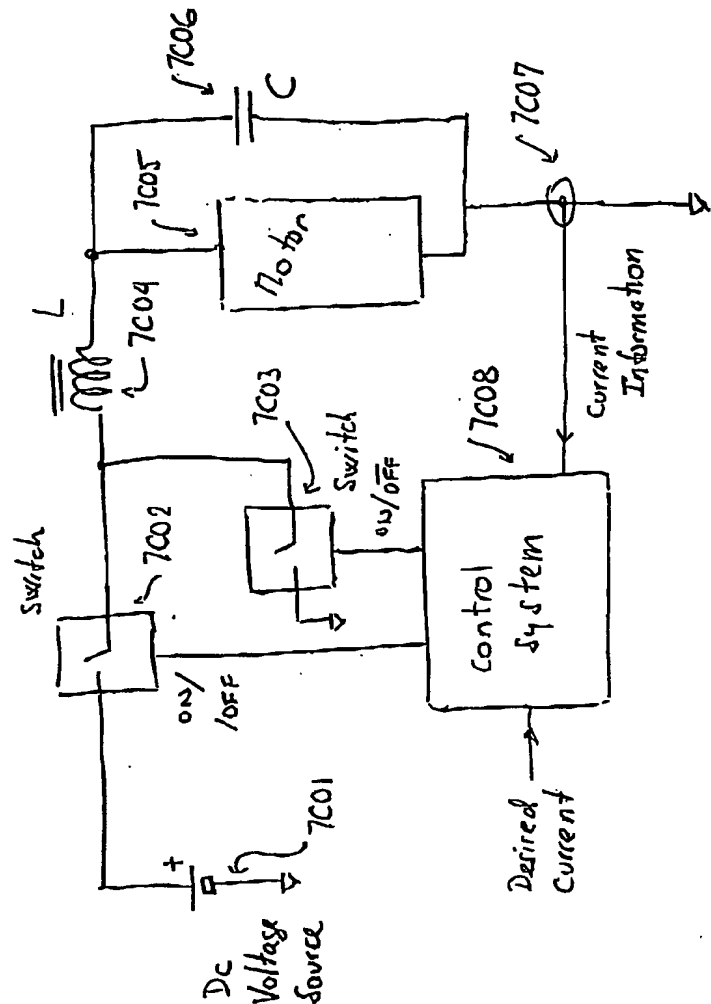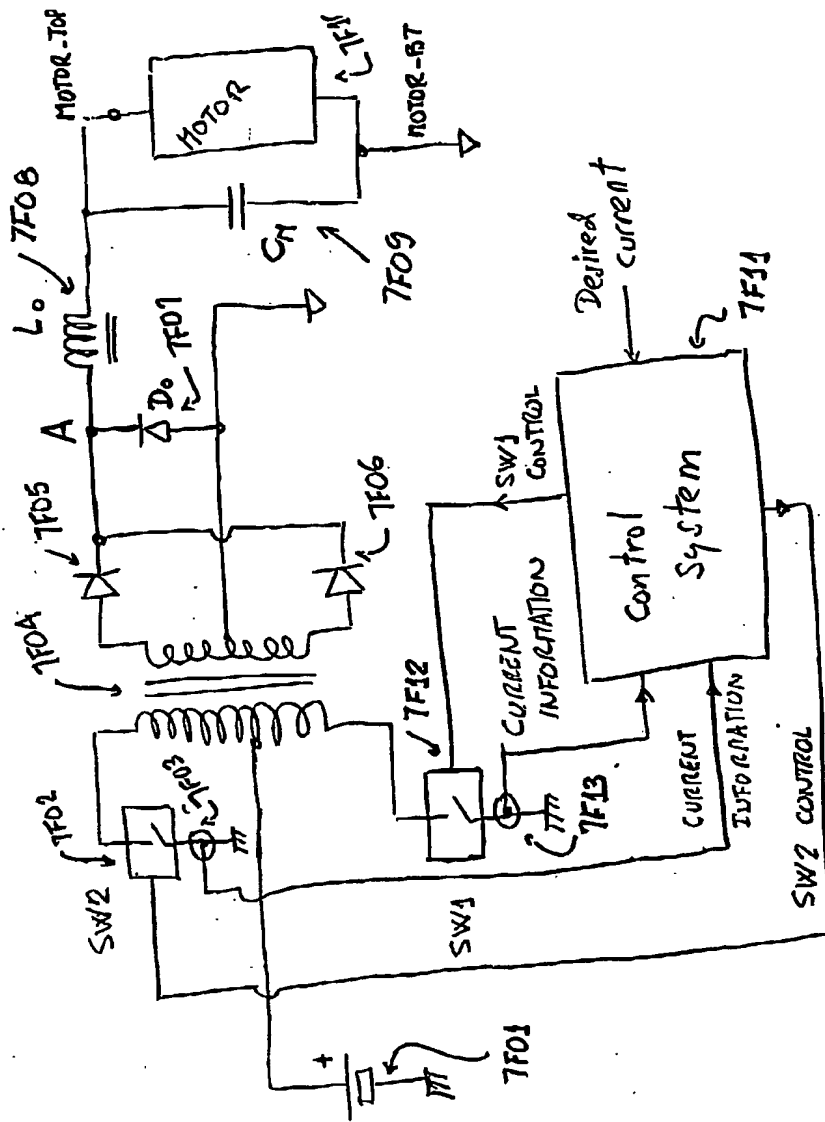
Fig 7C
With Synchronous rectification
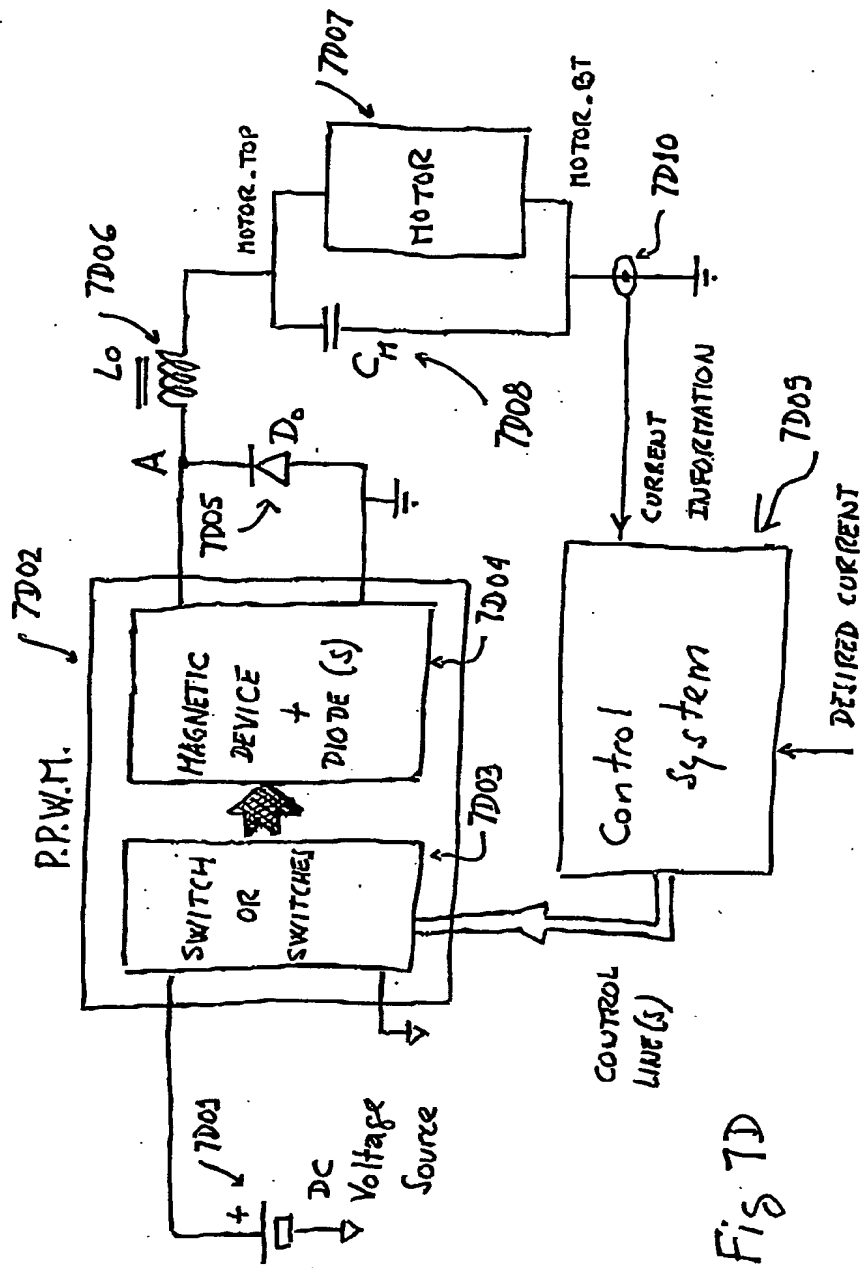
Fig 7D
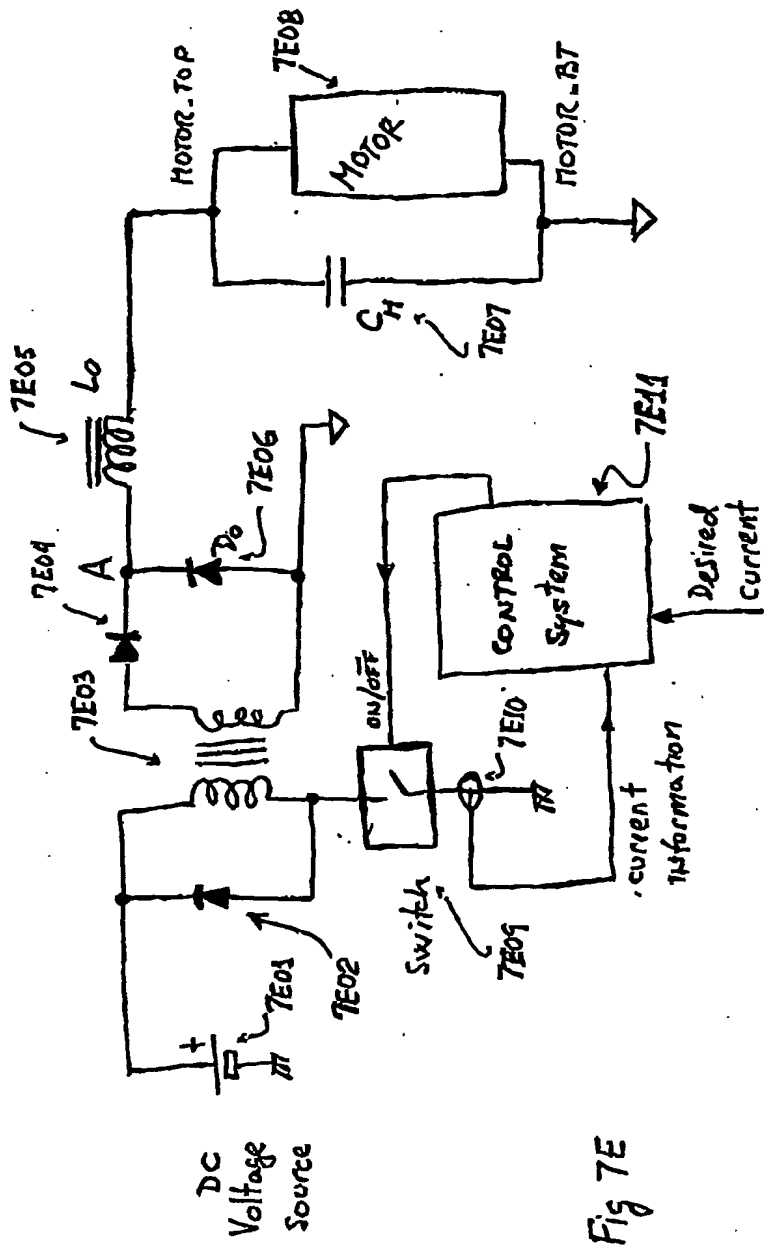
Fig 7E

Fig 7F

Fig 7G

Fig 7H

Fig 7I

Fig 7d

Fig 7k

Fig 7L

Fig 8A

Fig 8B

Fig 8C

Fig 9A

Fig 9B

Fig 9C

Fig 9D

Fig 9E

Fig 9F

Fig 9h

Fig 9G

Fig 9I

Fig 9J

Fig 9k

Fig. 9L

Fig 10A

Fig 10B

Fig 10C

Fig 10D

Fig 10E

Fig 11A

Fig 11B

Fig 12

Fig 13

Fig 14
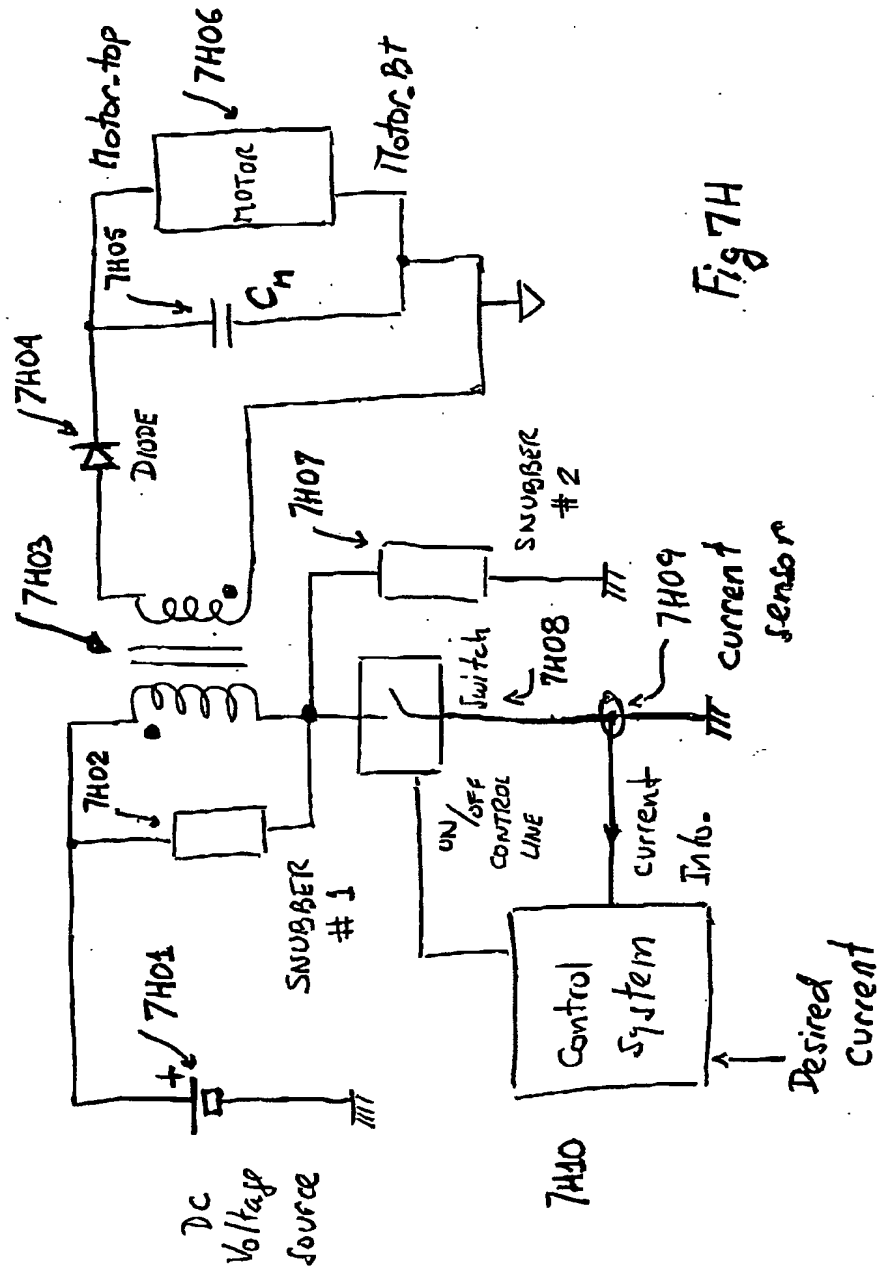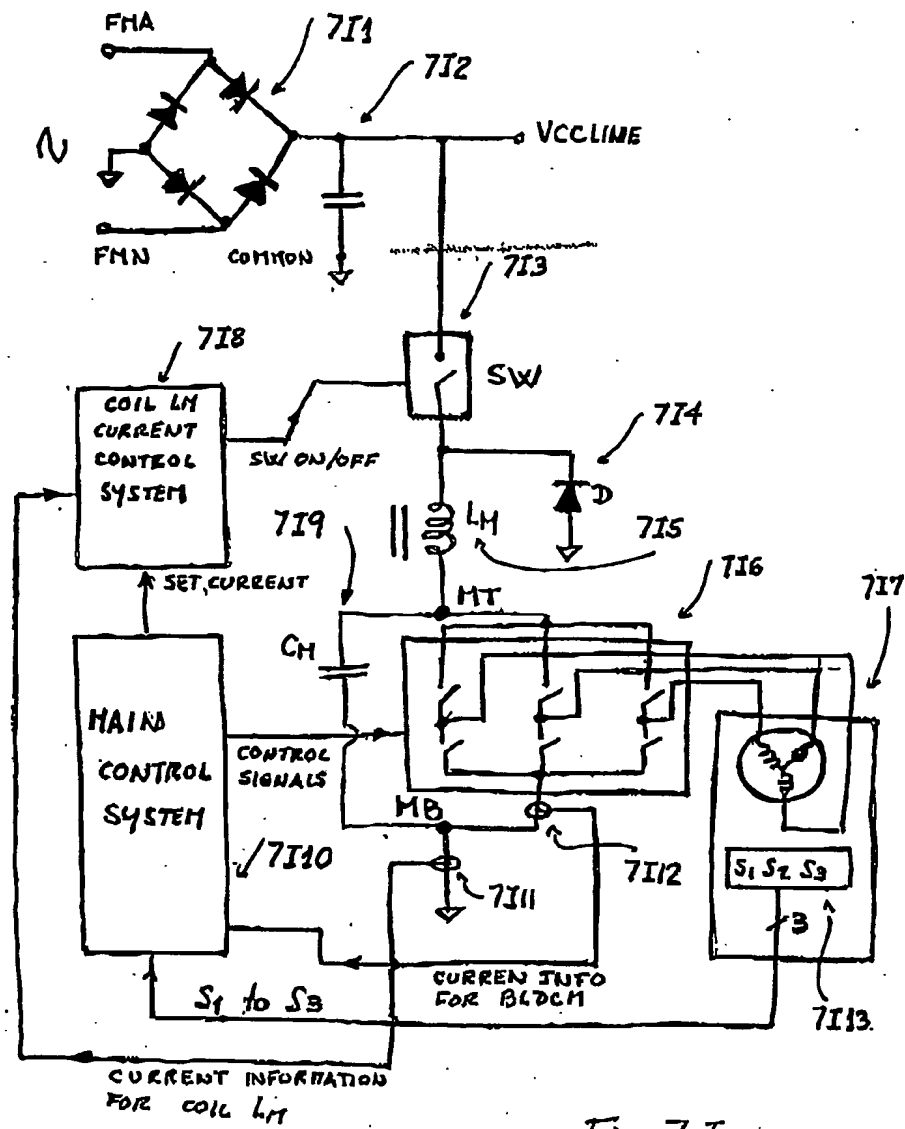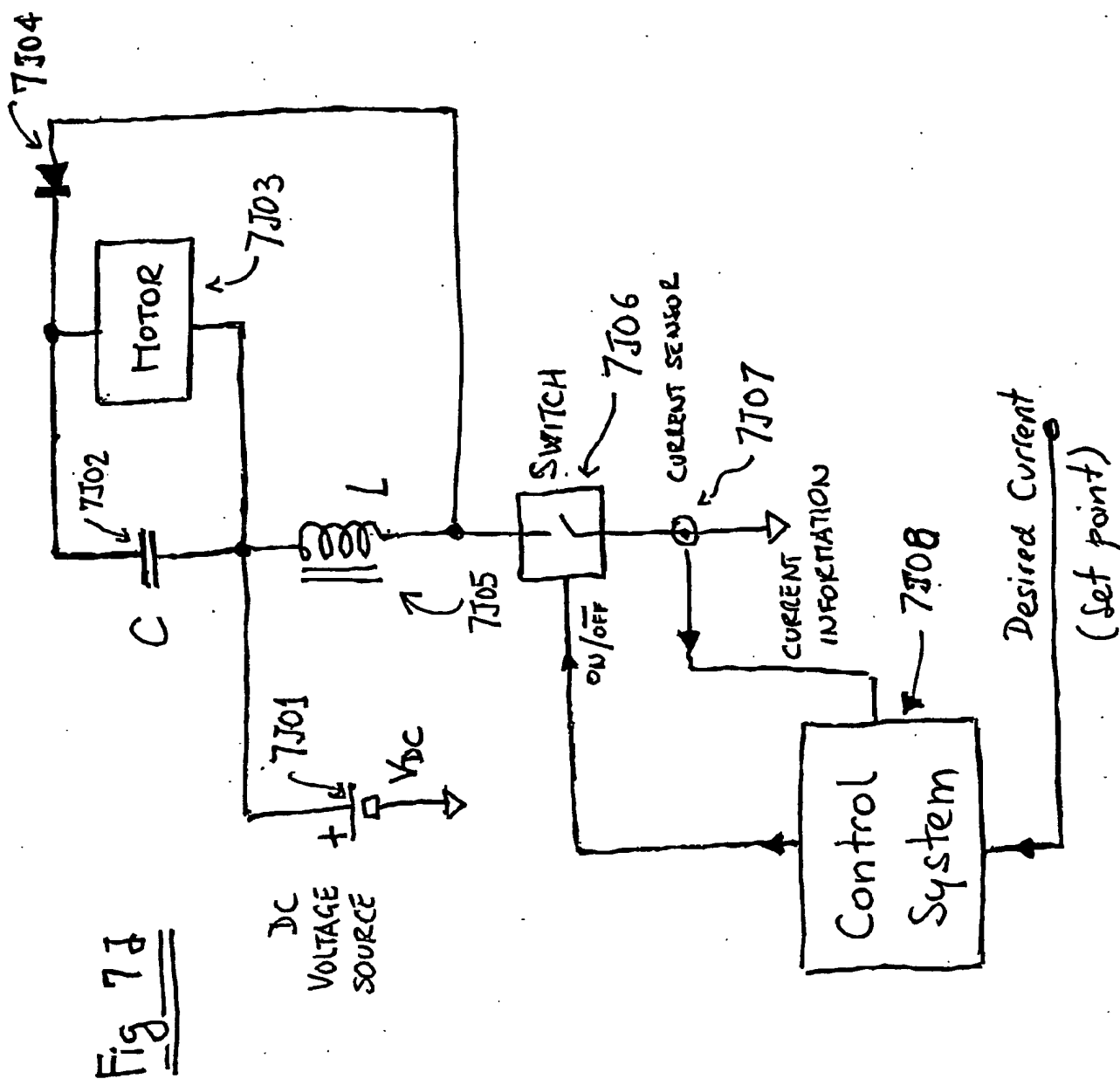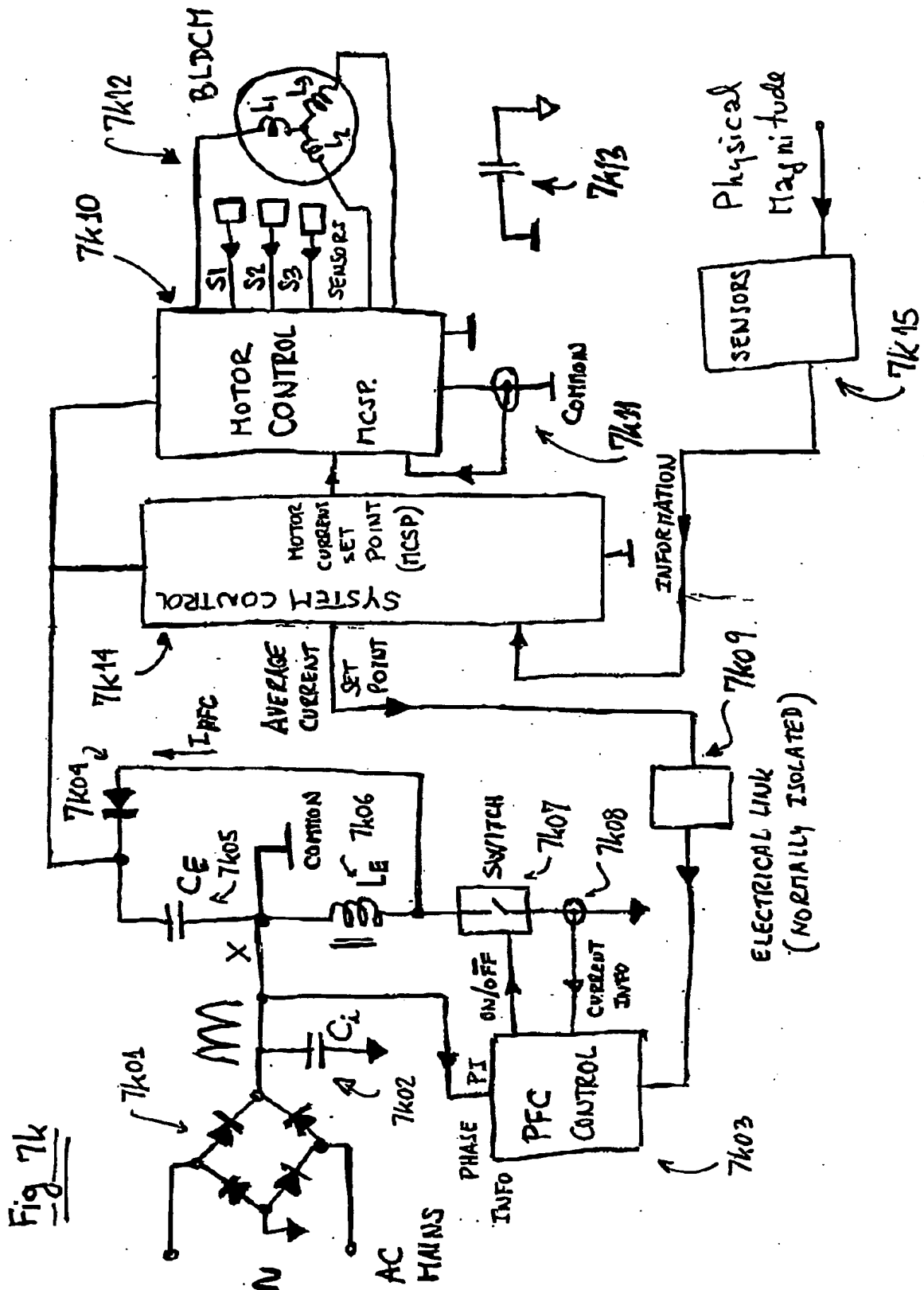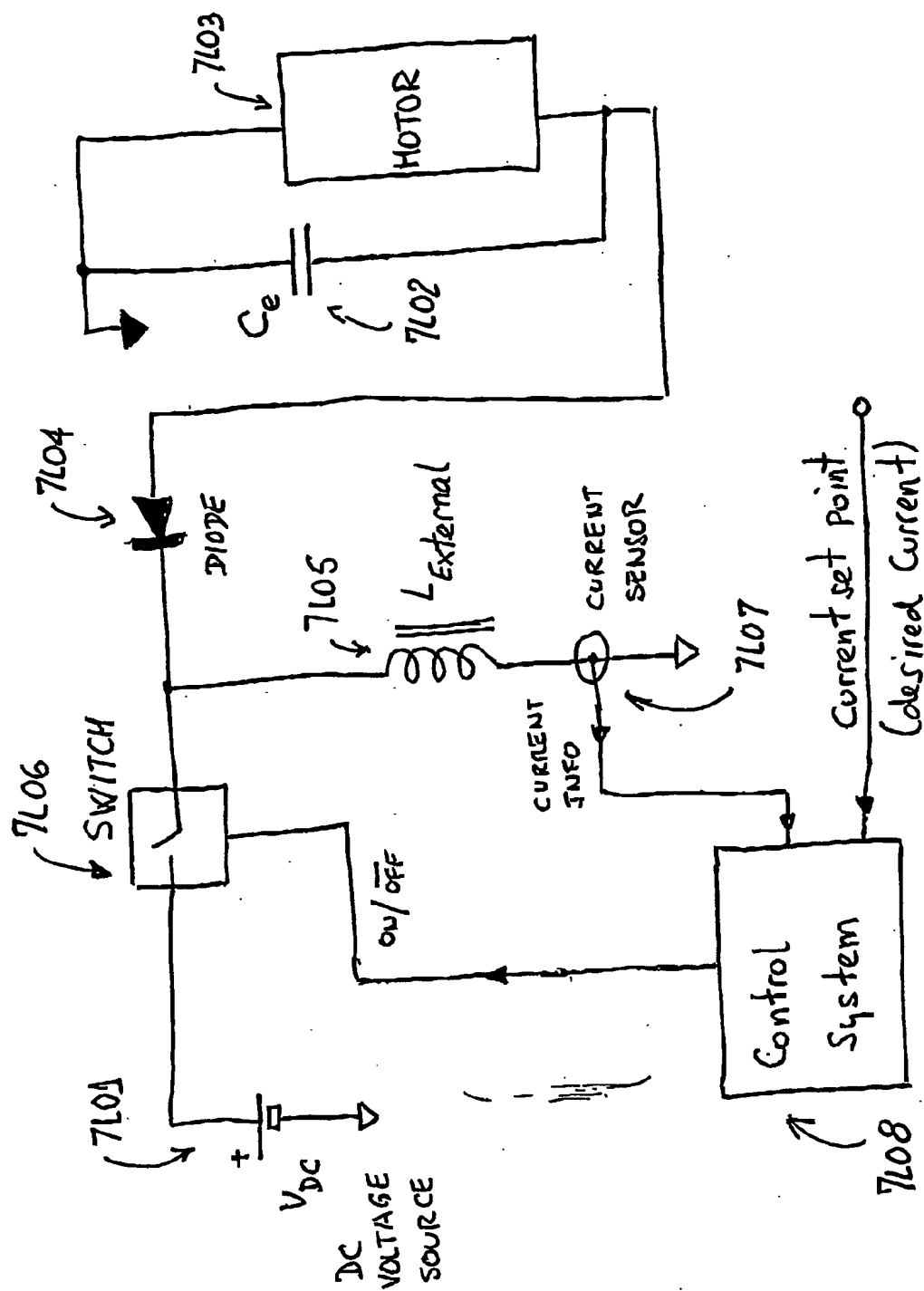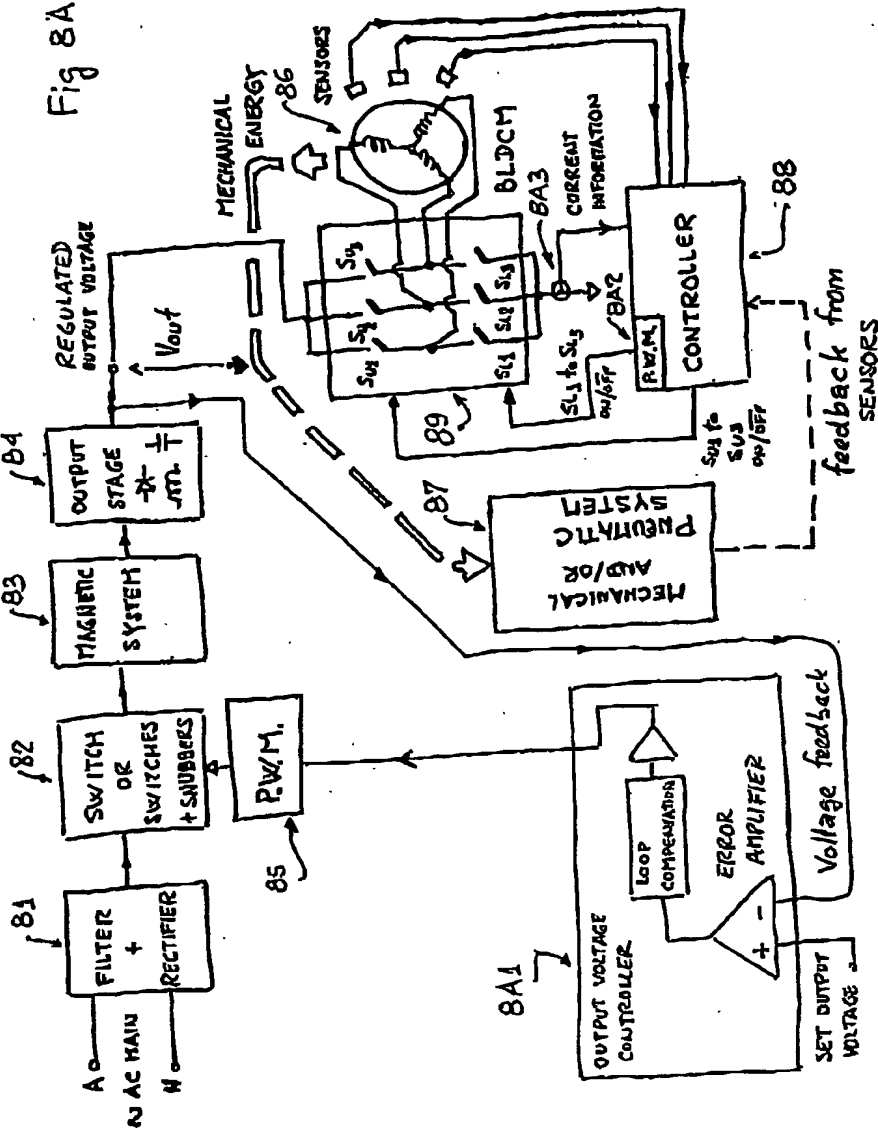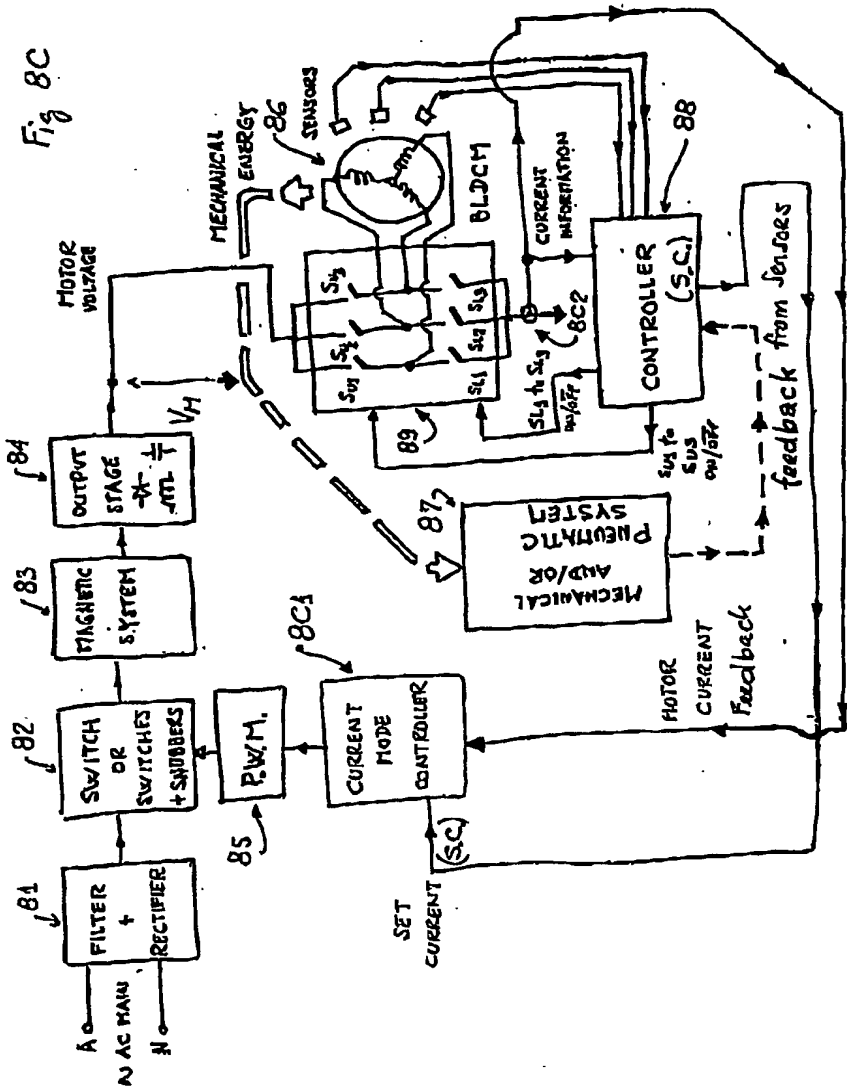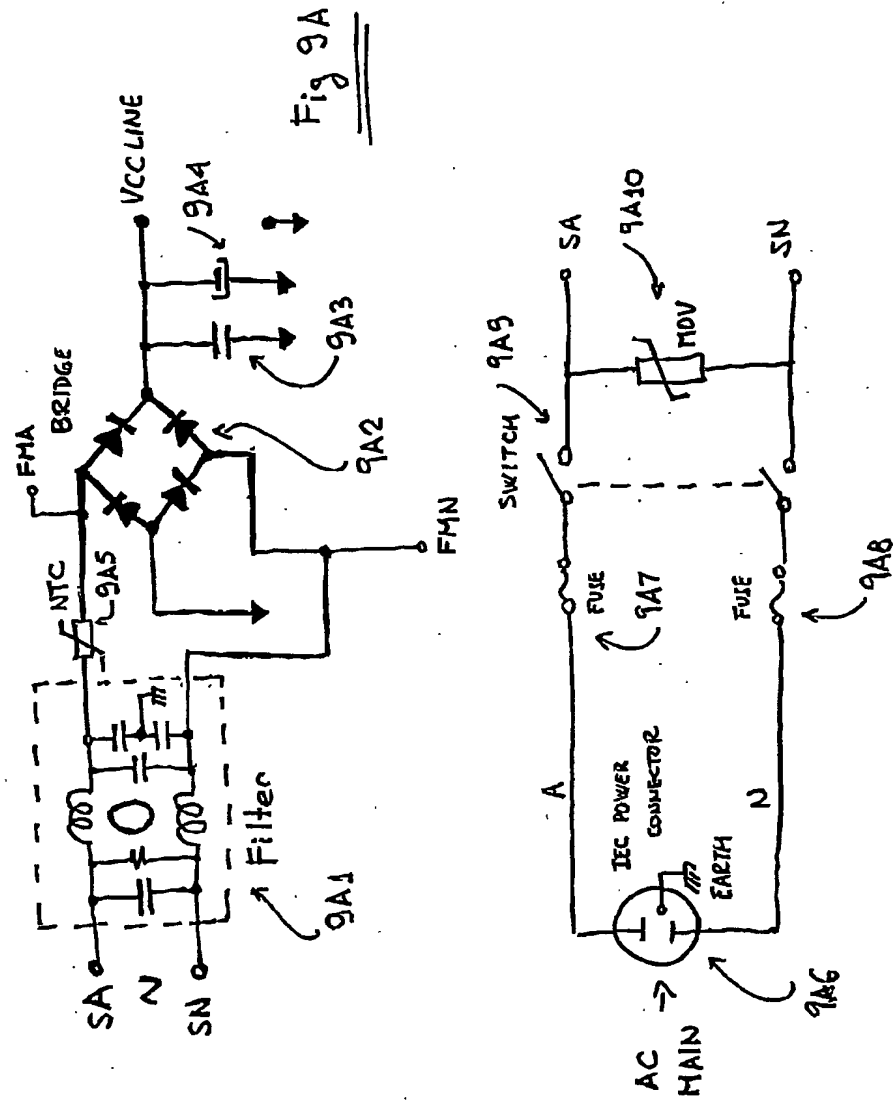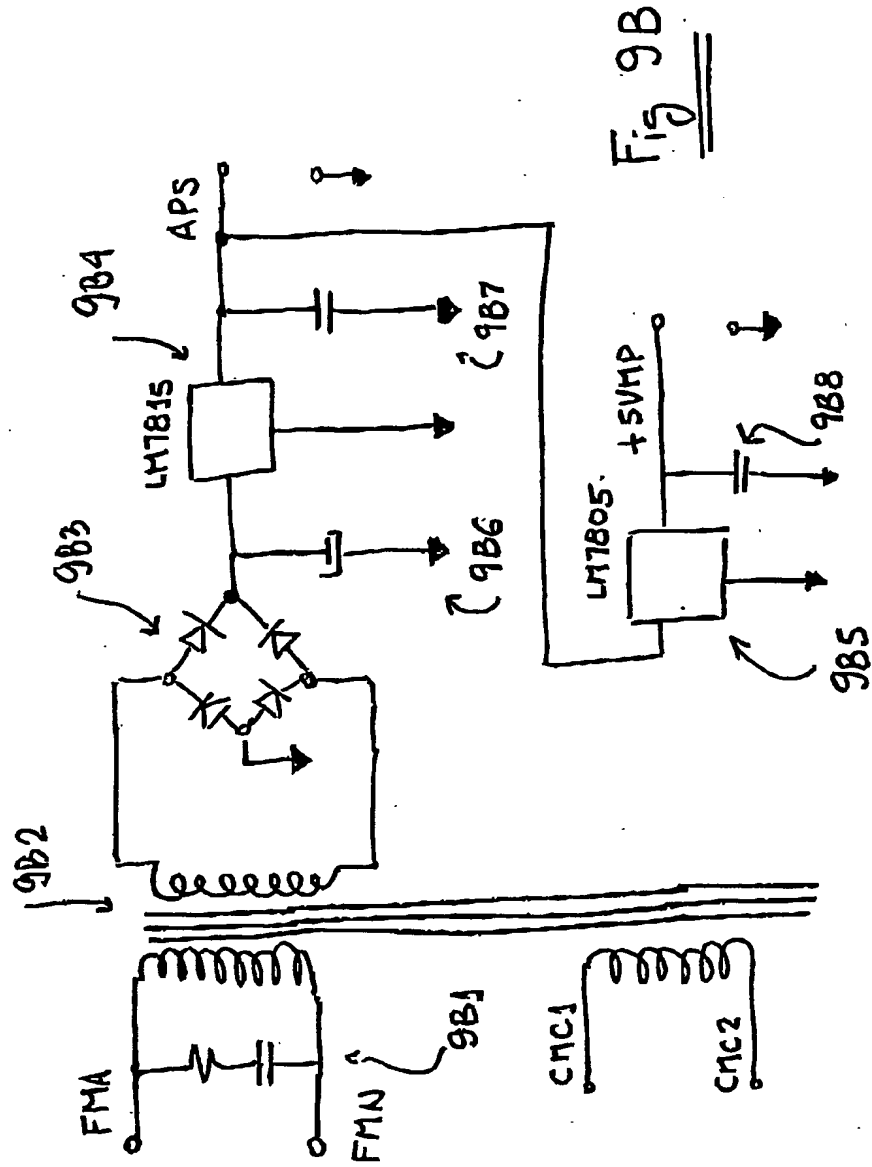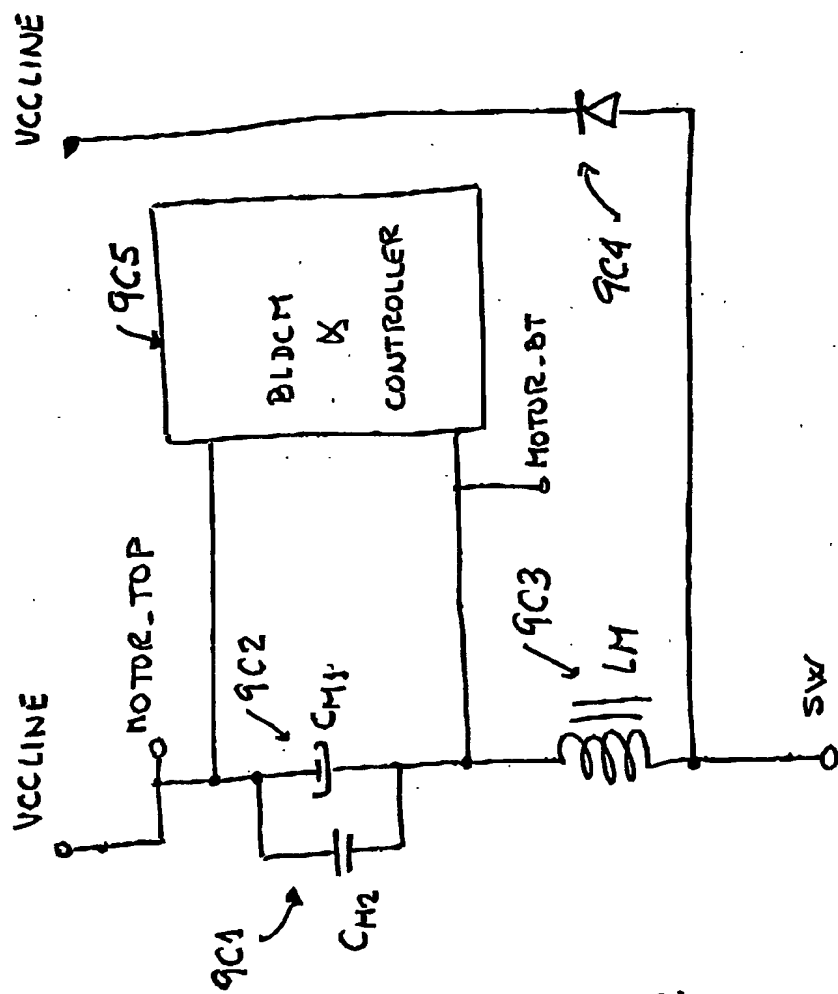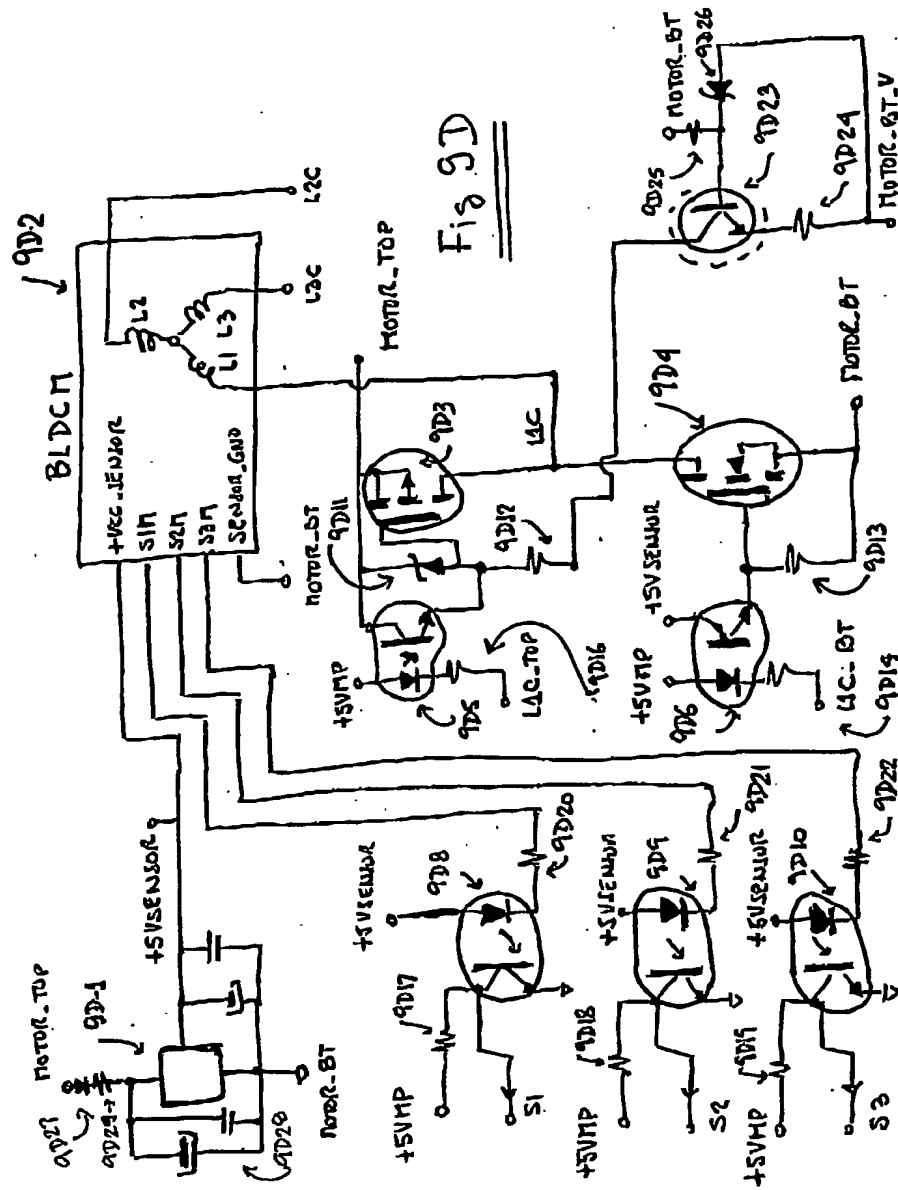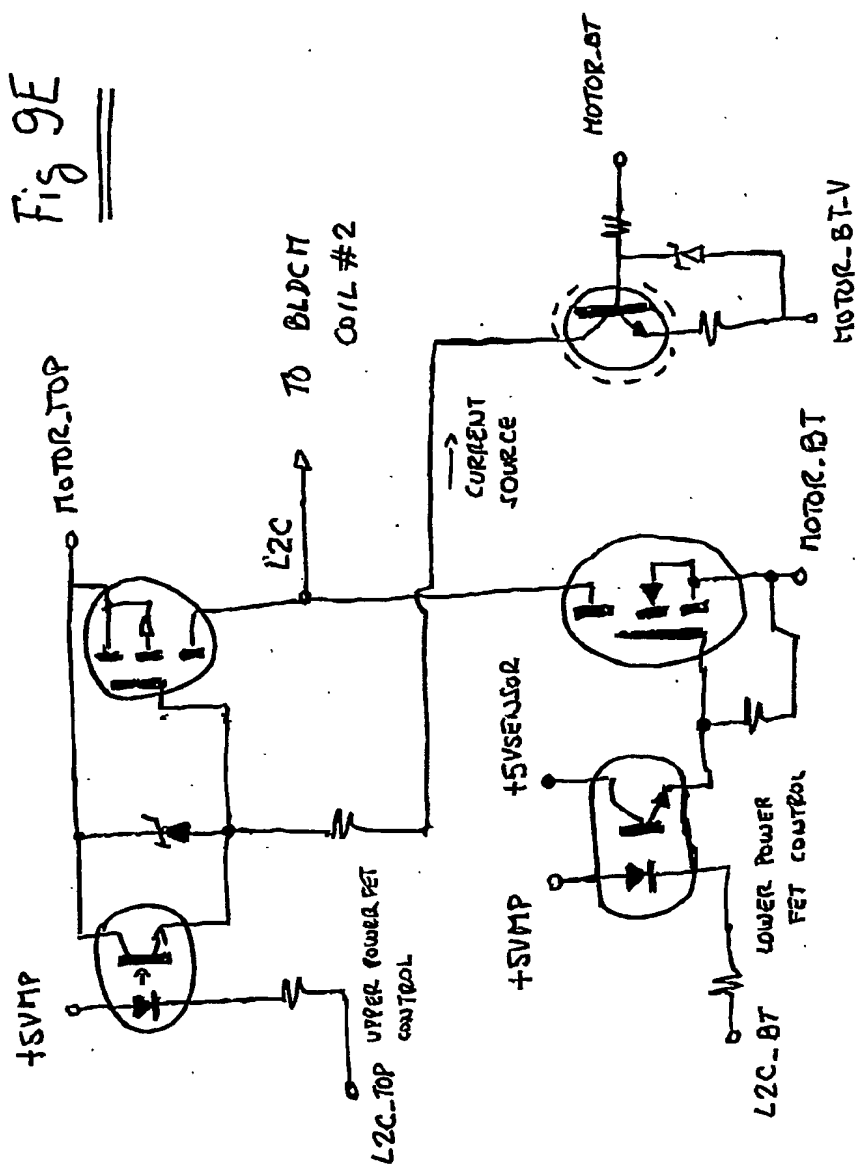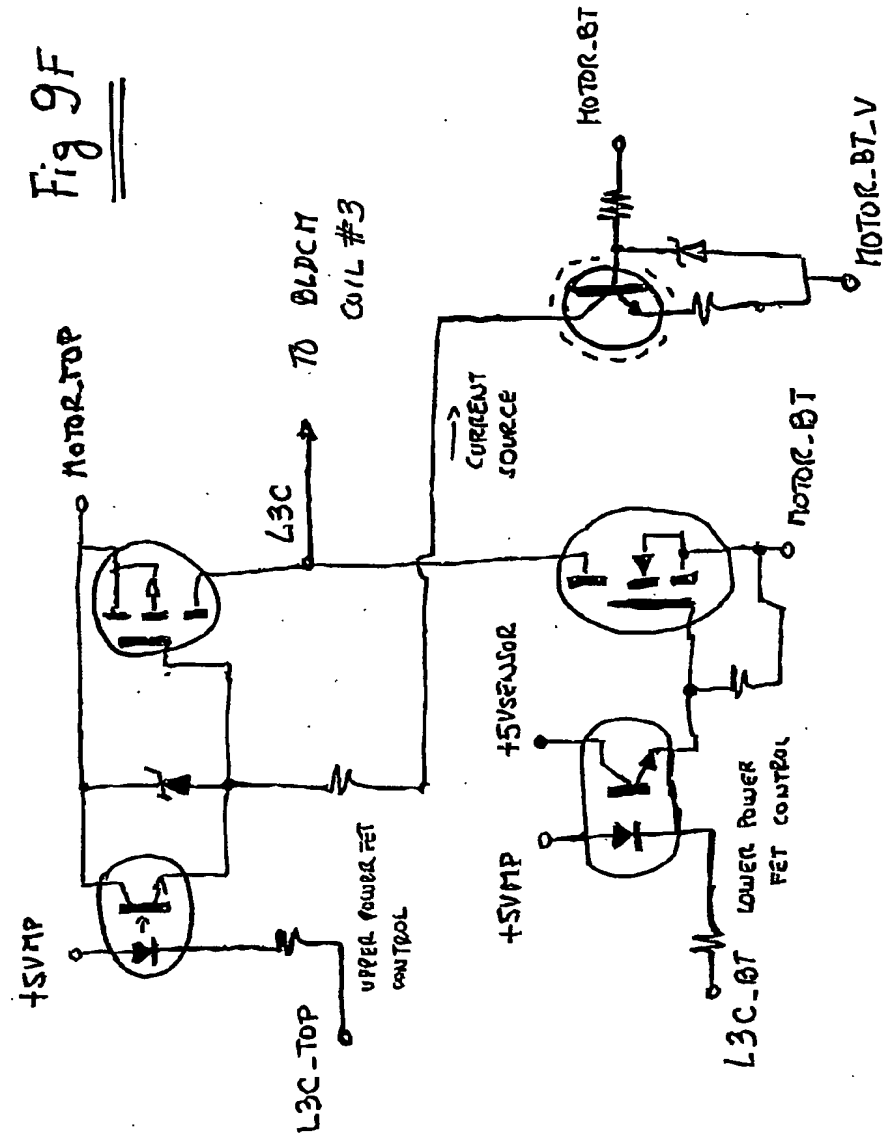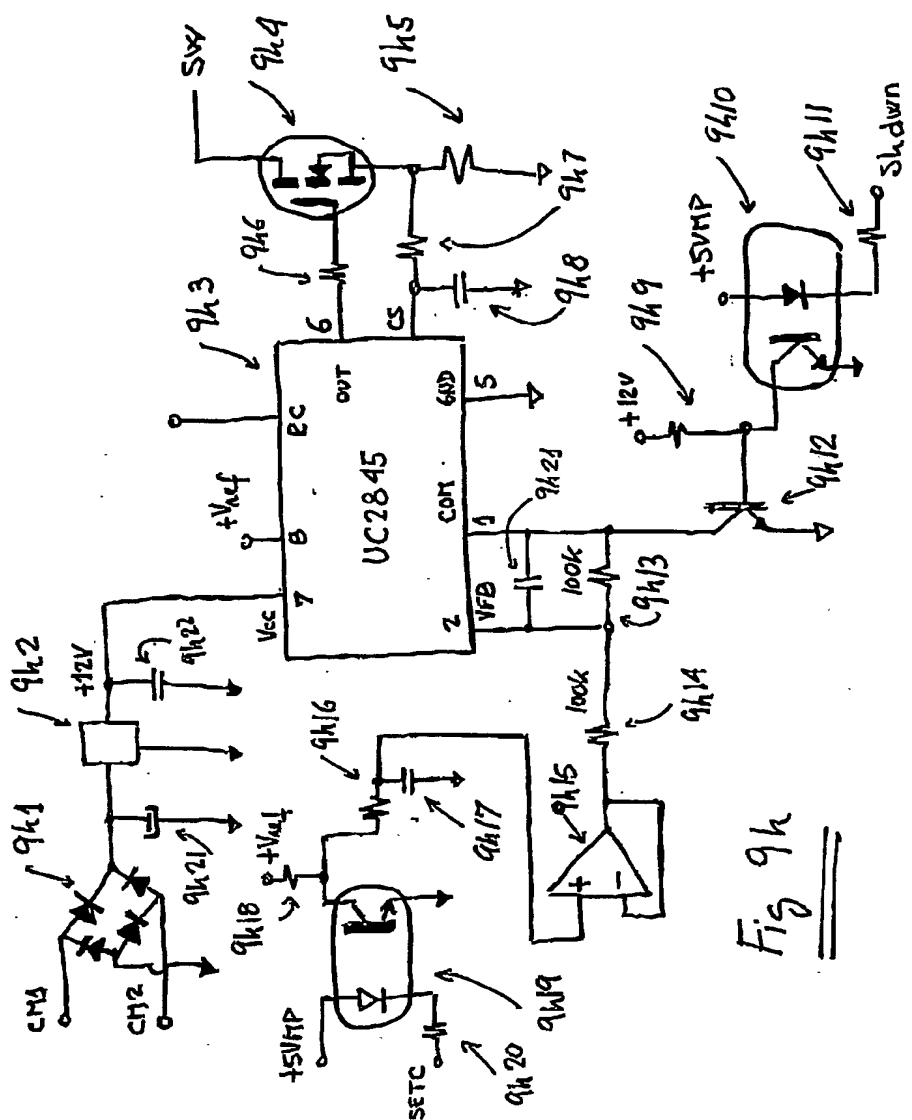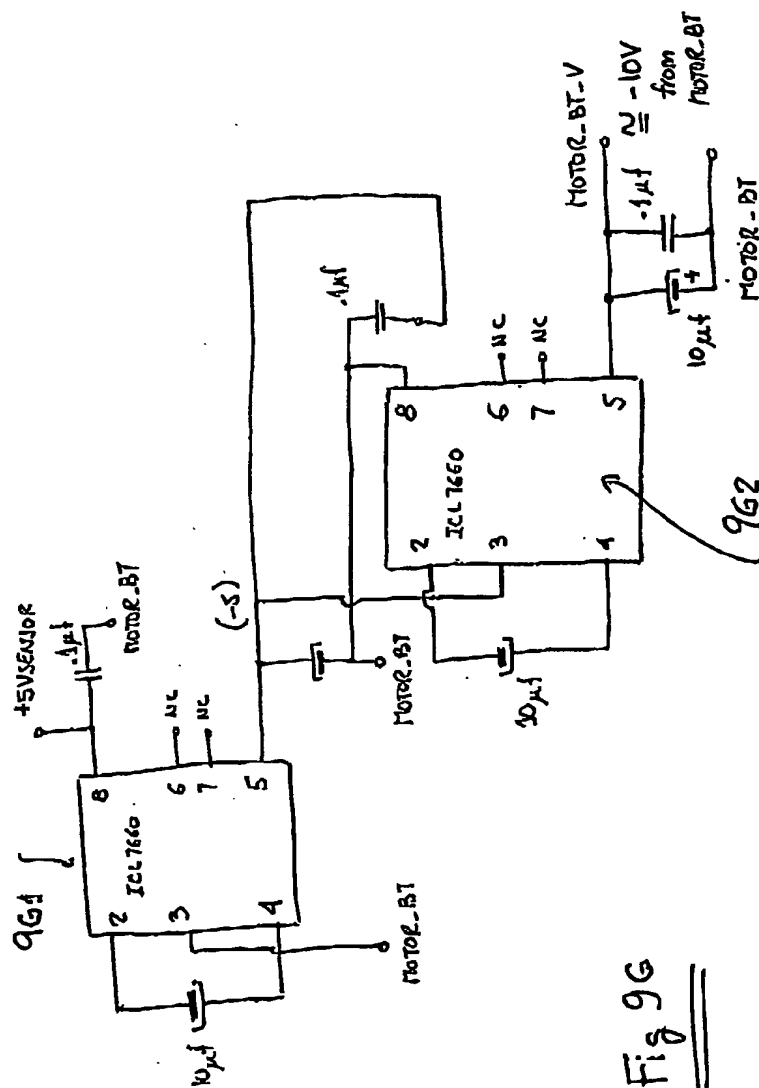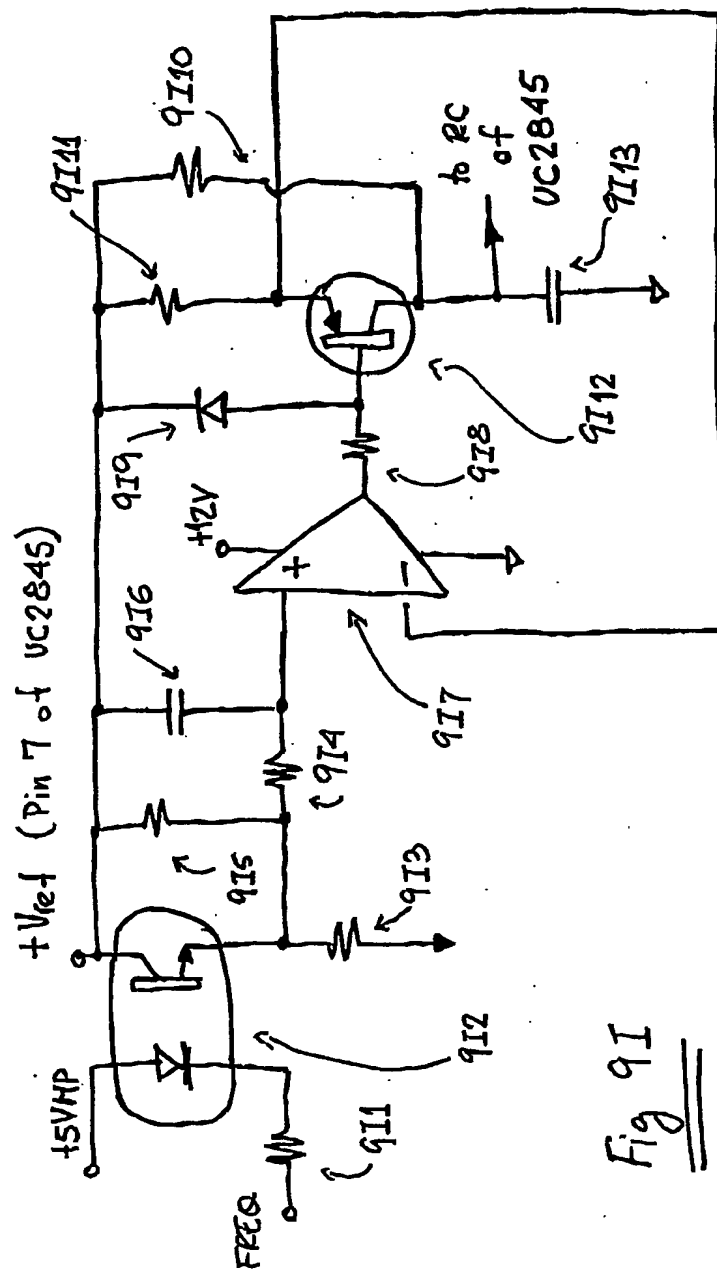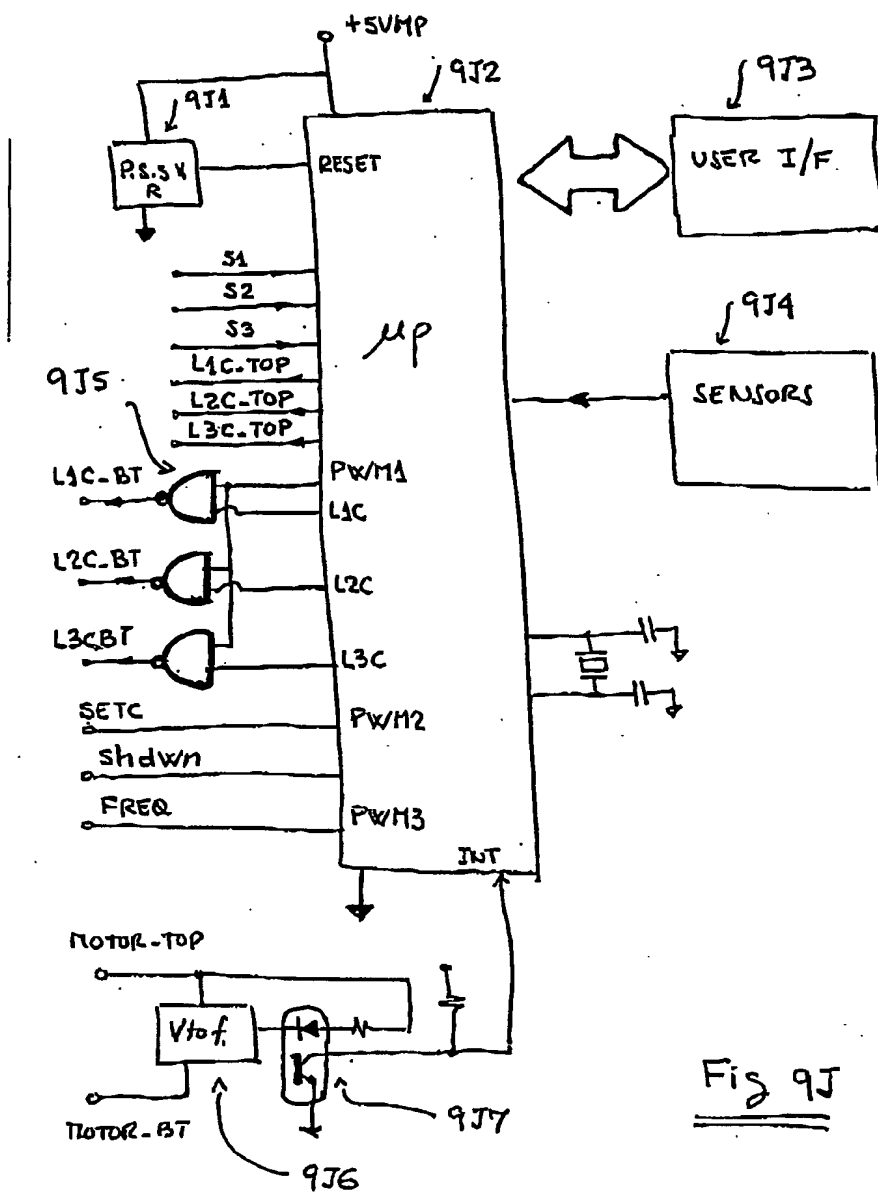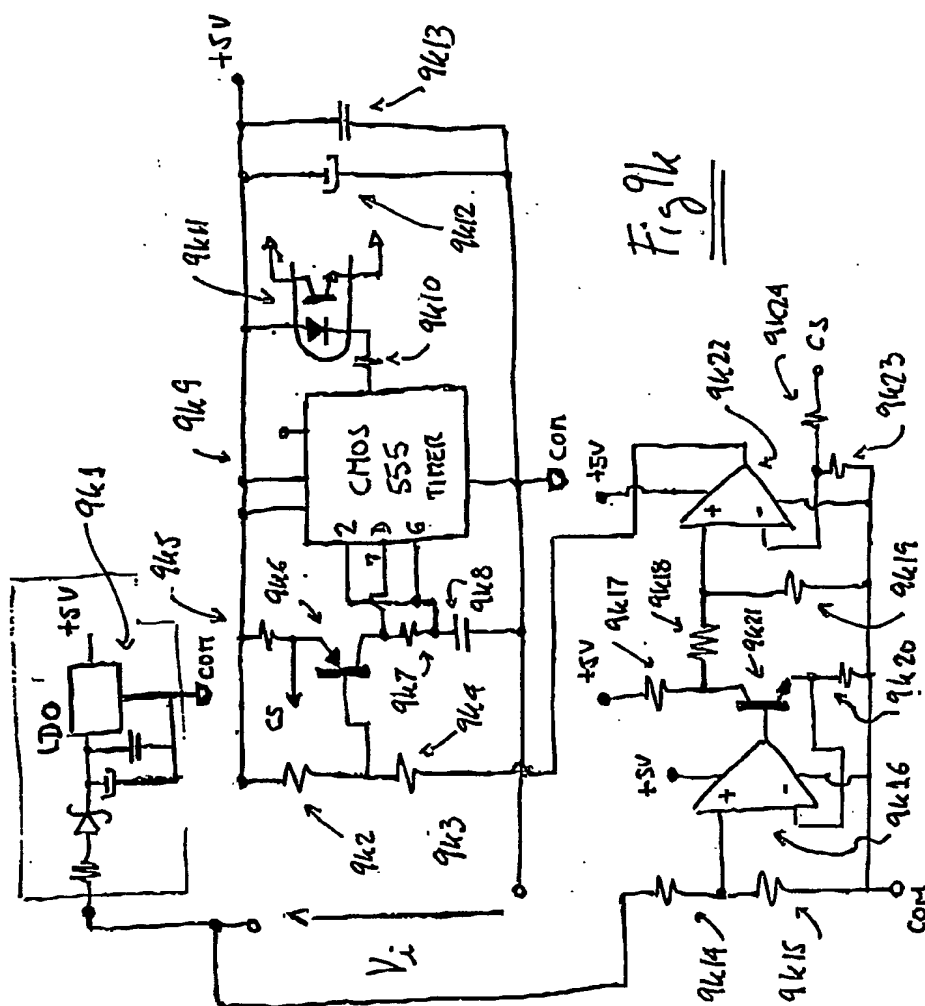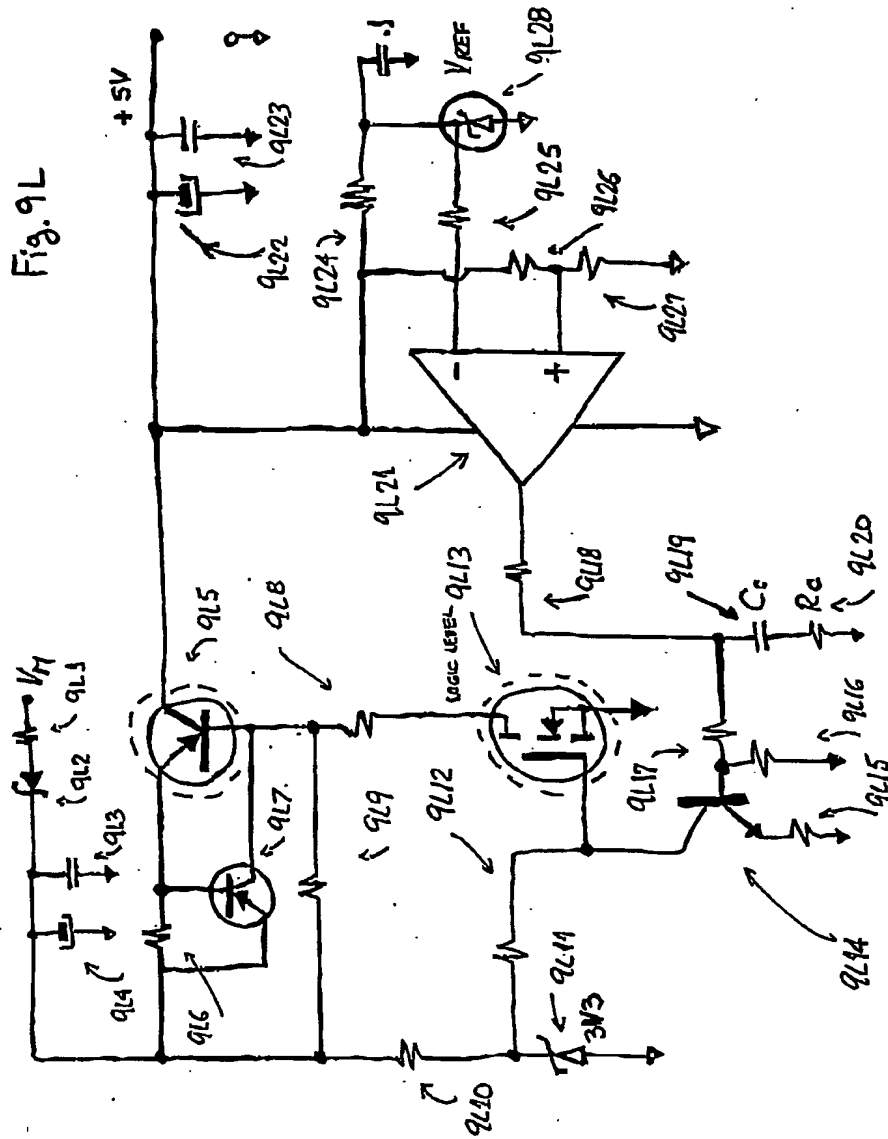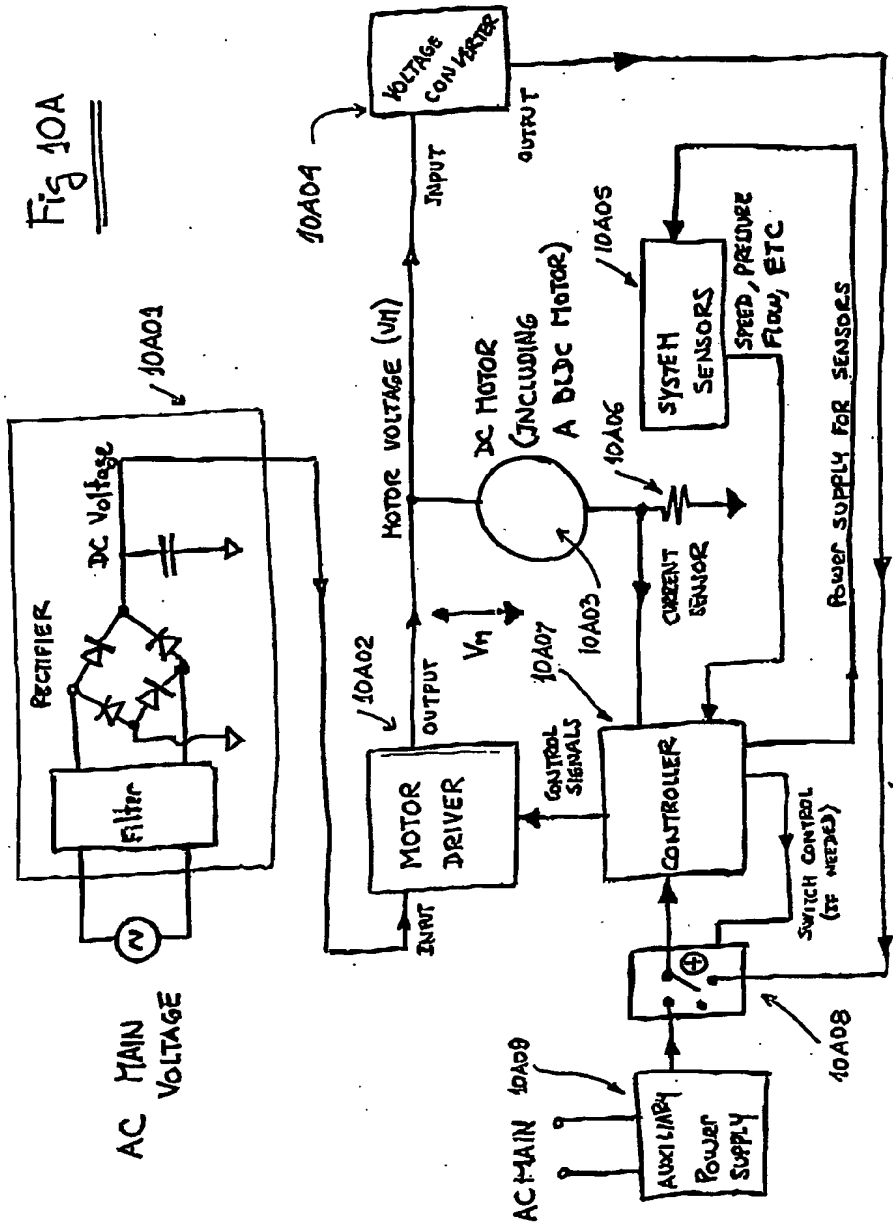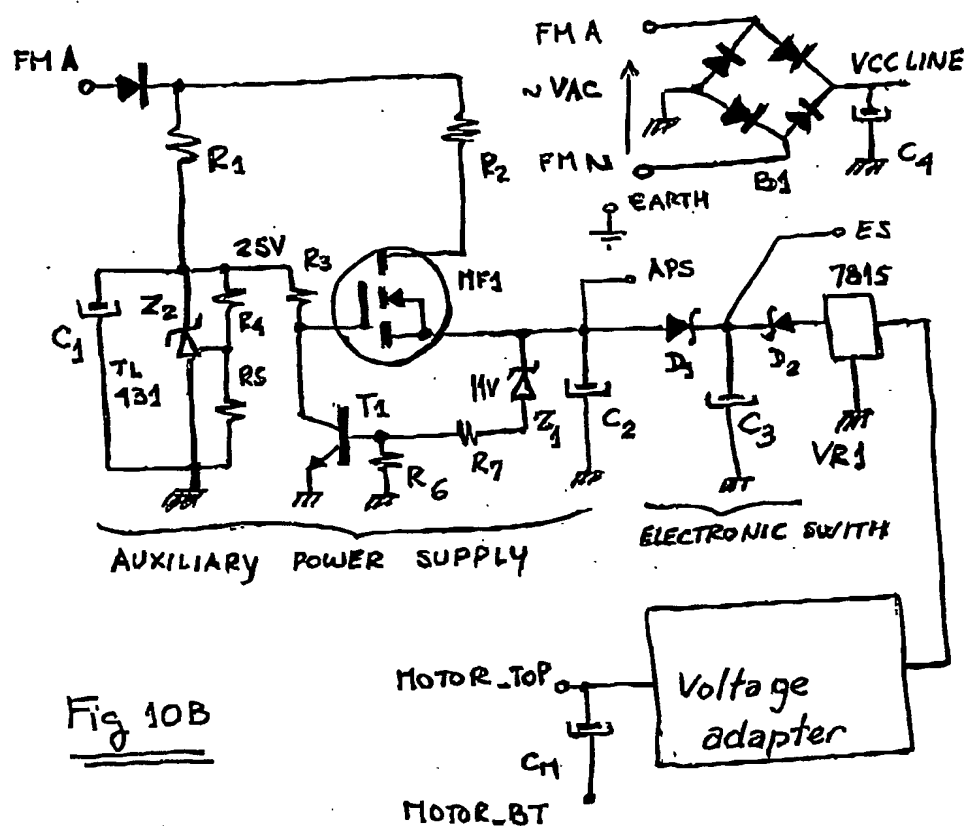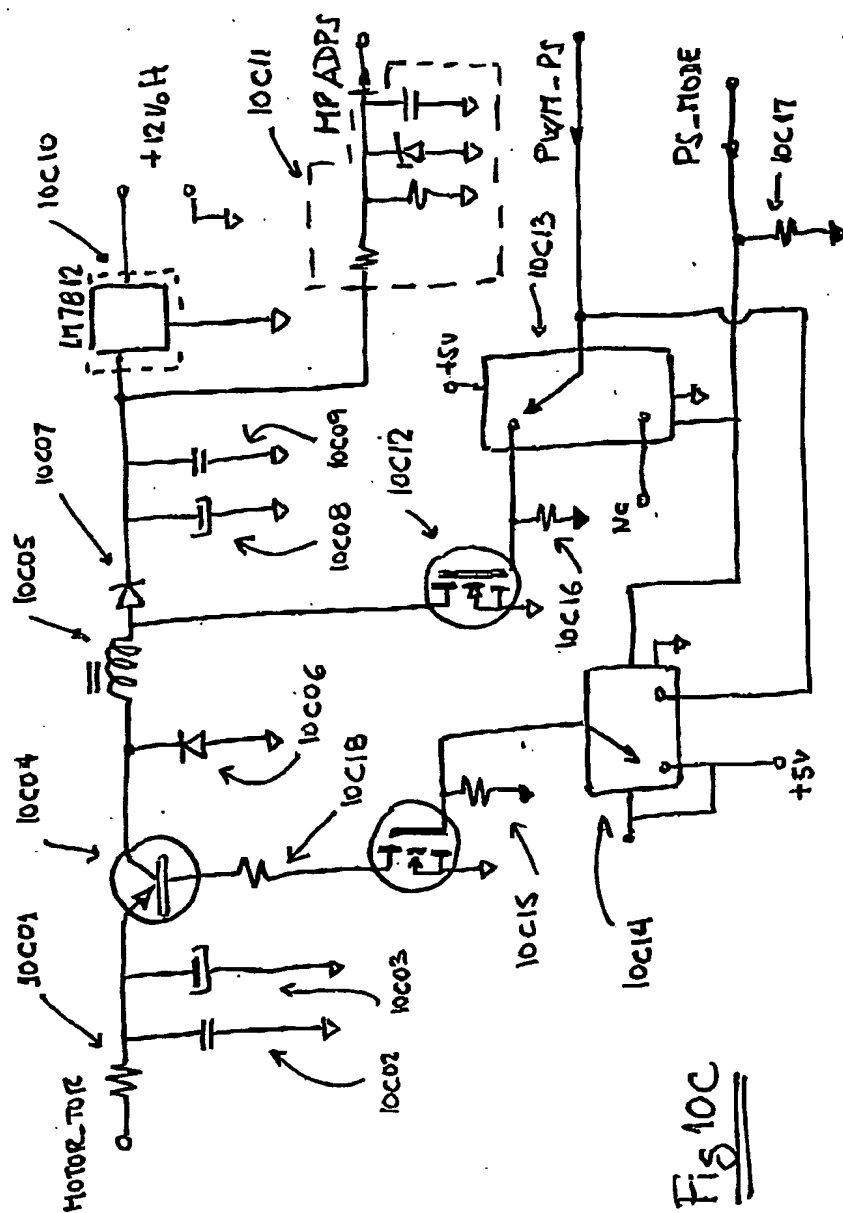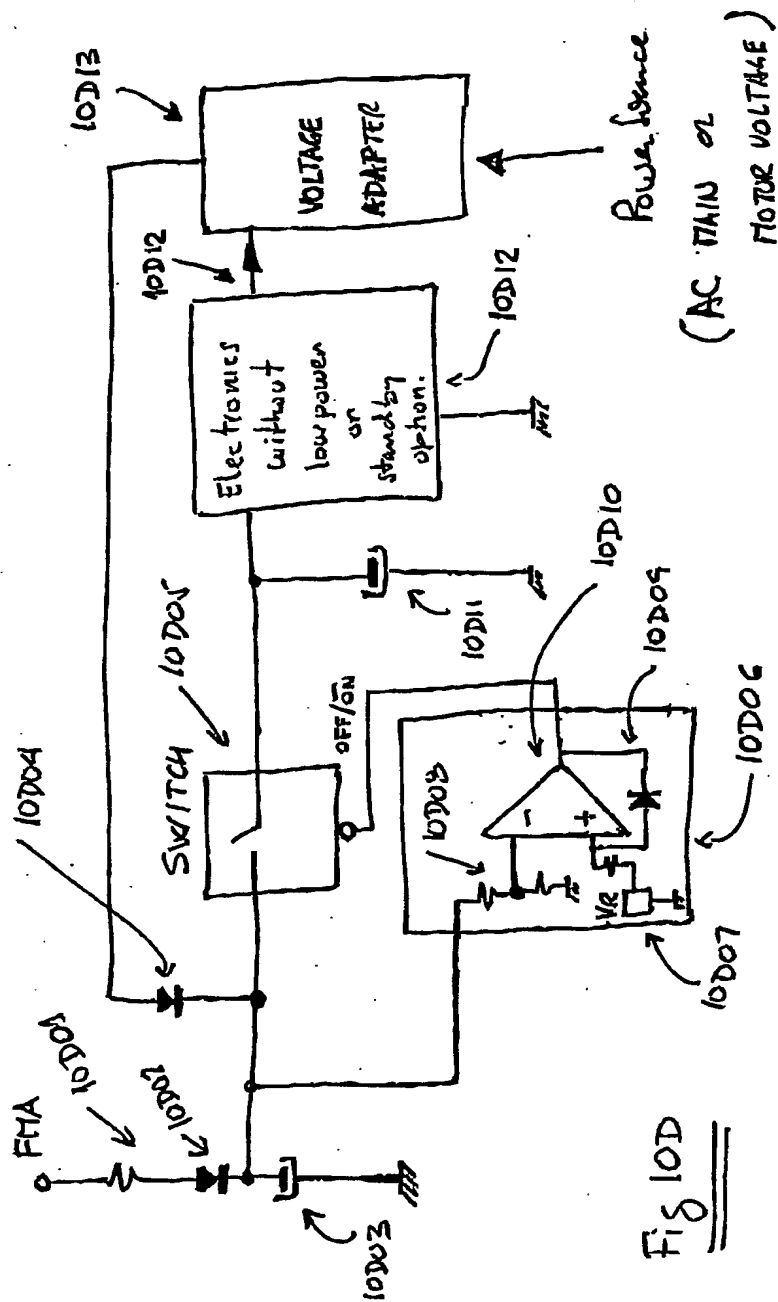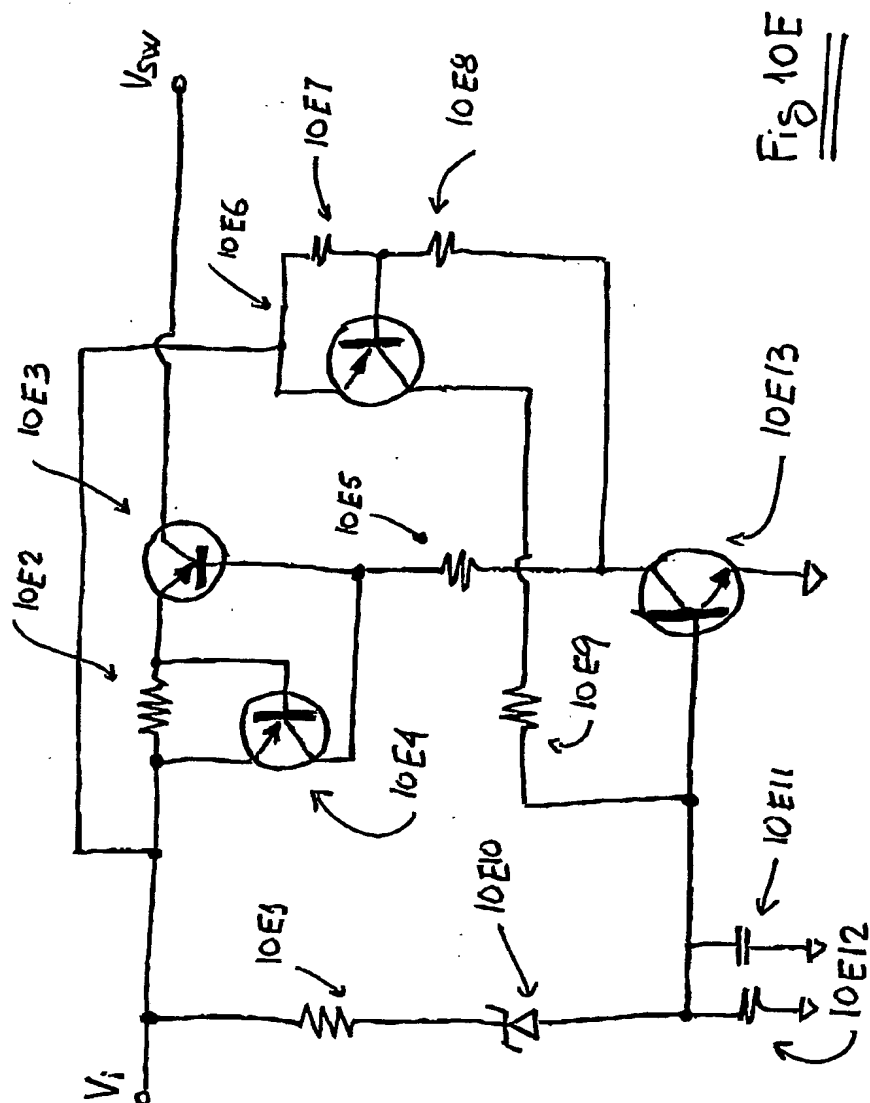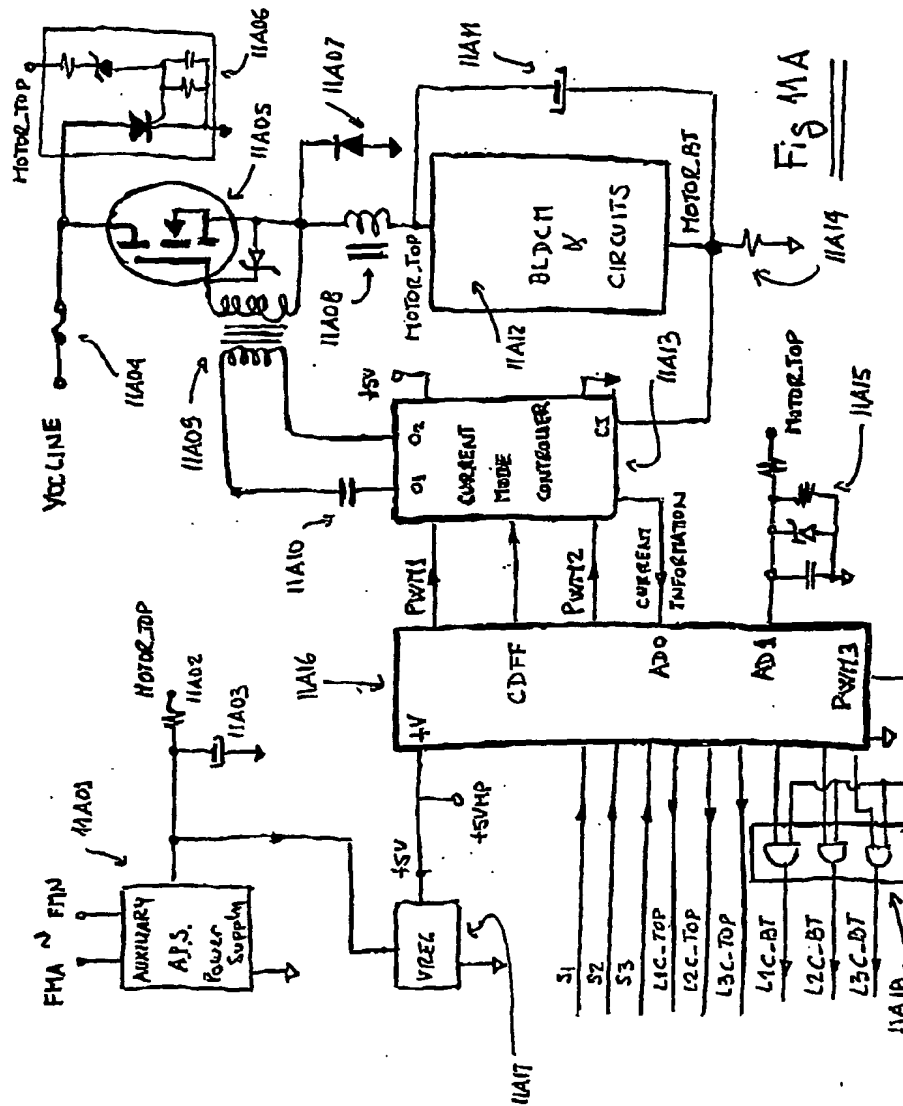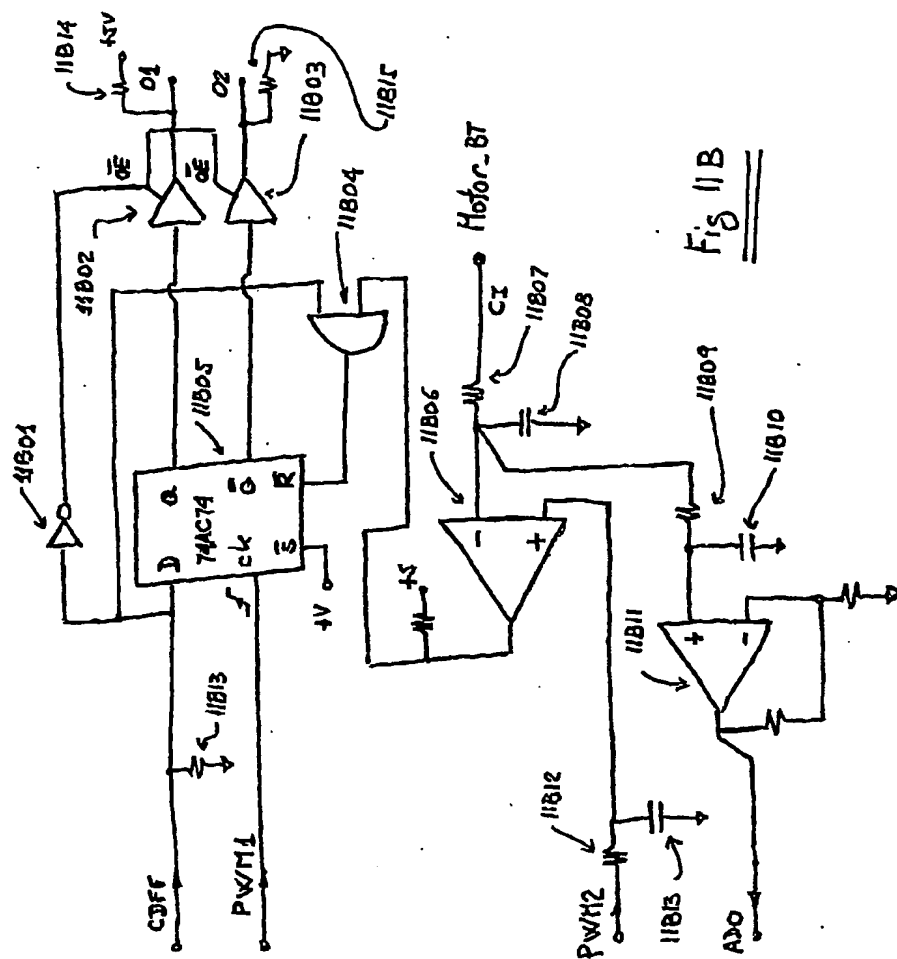
Fig 15

$$(1501) \quad V_M \cong I_M R_M + V_{emf}$$

$$(1502) \quad V_{emf} = k_v \omega_M$$

$$\begin{cases} V_{SW} + V_{SENSOR} \ll V_L & (1503) \\ V_D \ll V_M & (1504) \end{cases}$$

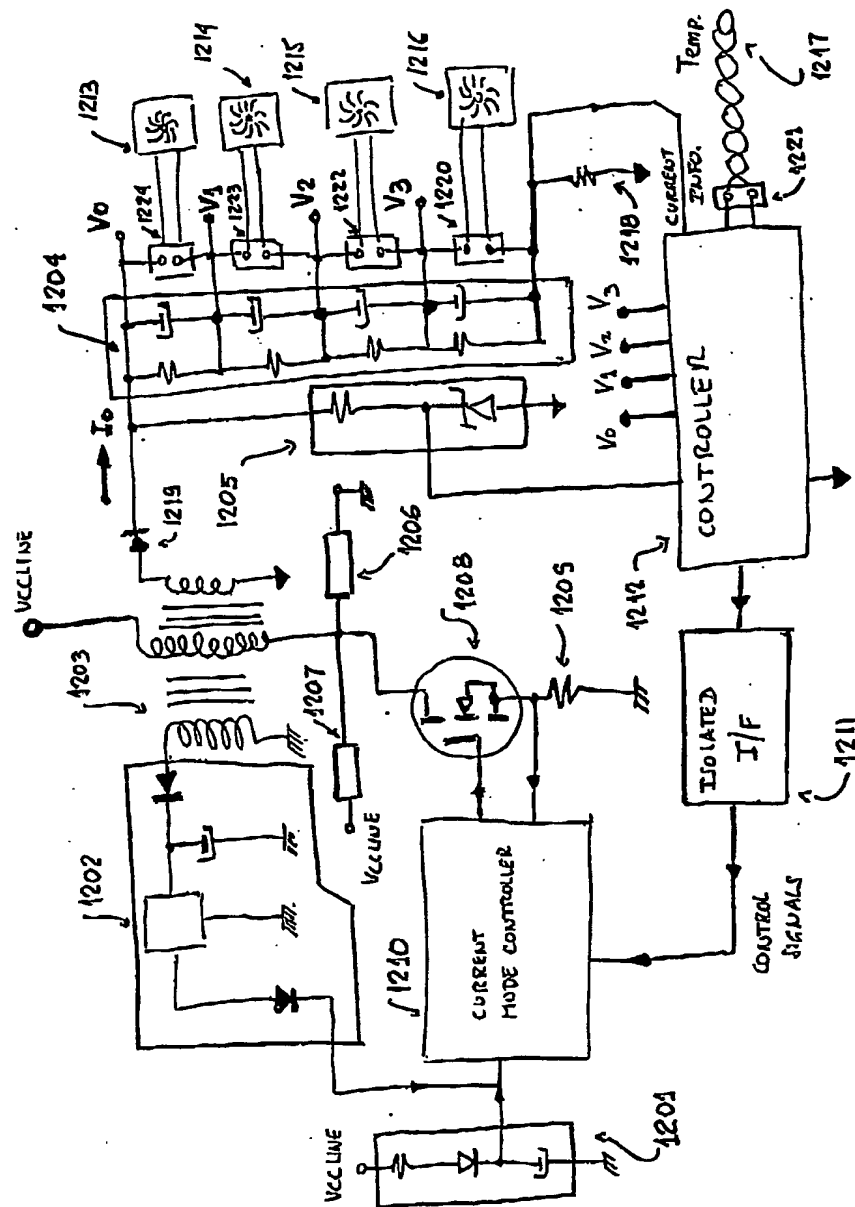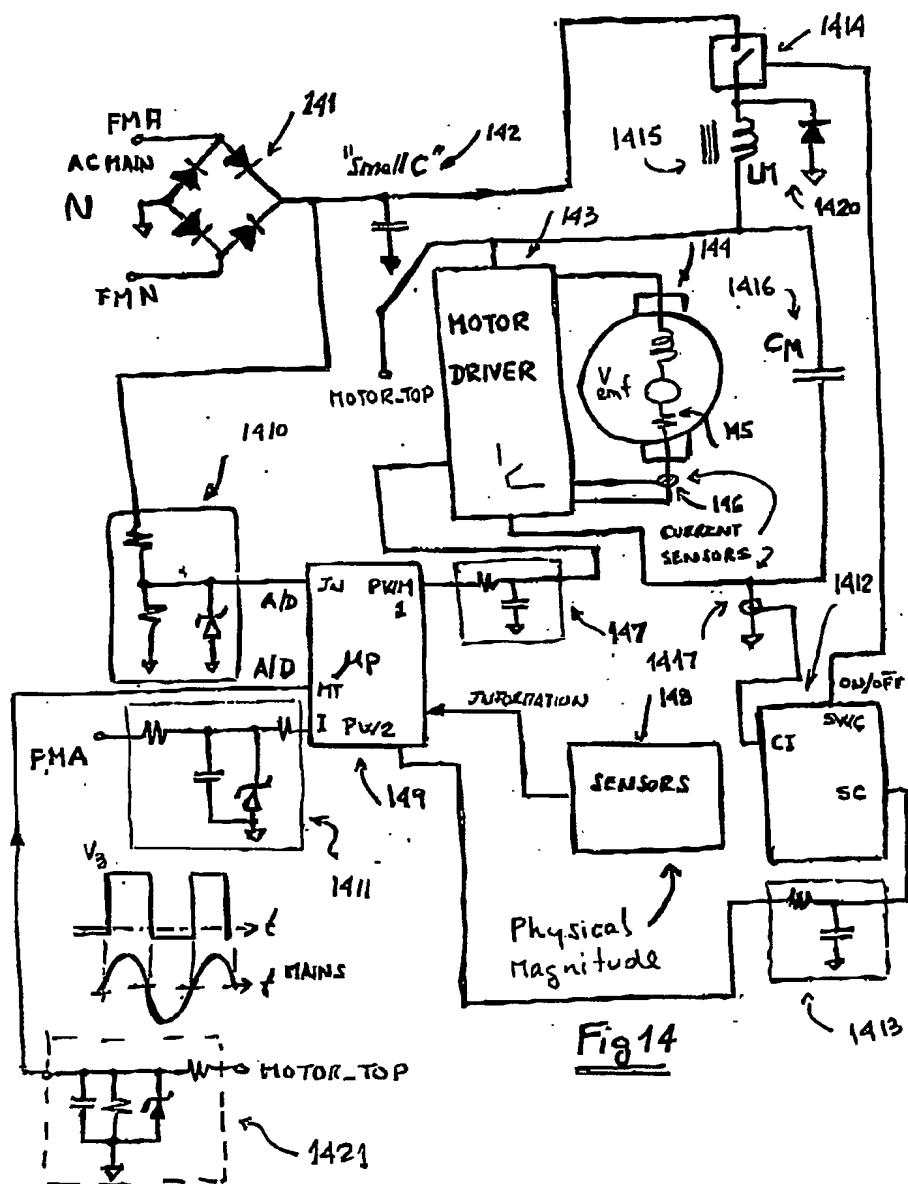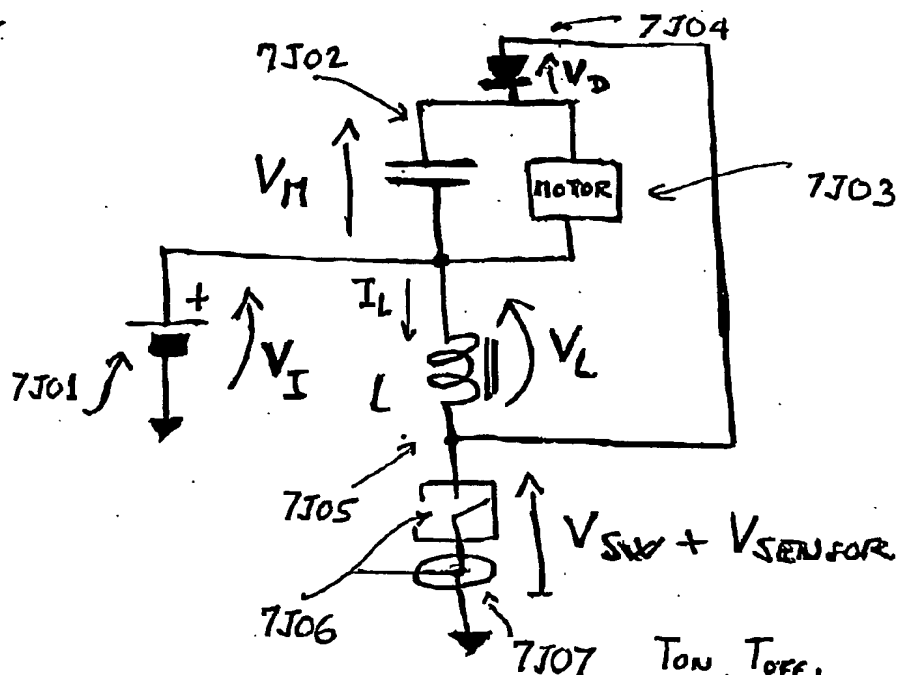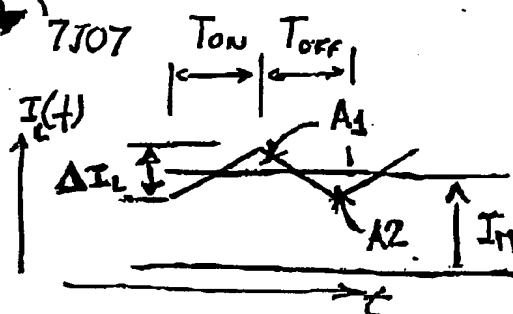$$\Rightarrow \quad \Delta I_L = \frac{V_I}{L_M} T_{ON} = \frac{V_M}{L_M} T_{OFF} \quad (1505)$$

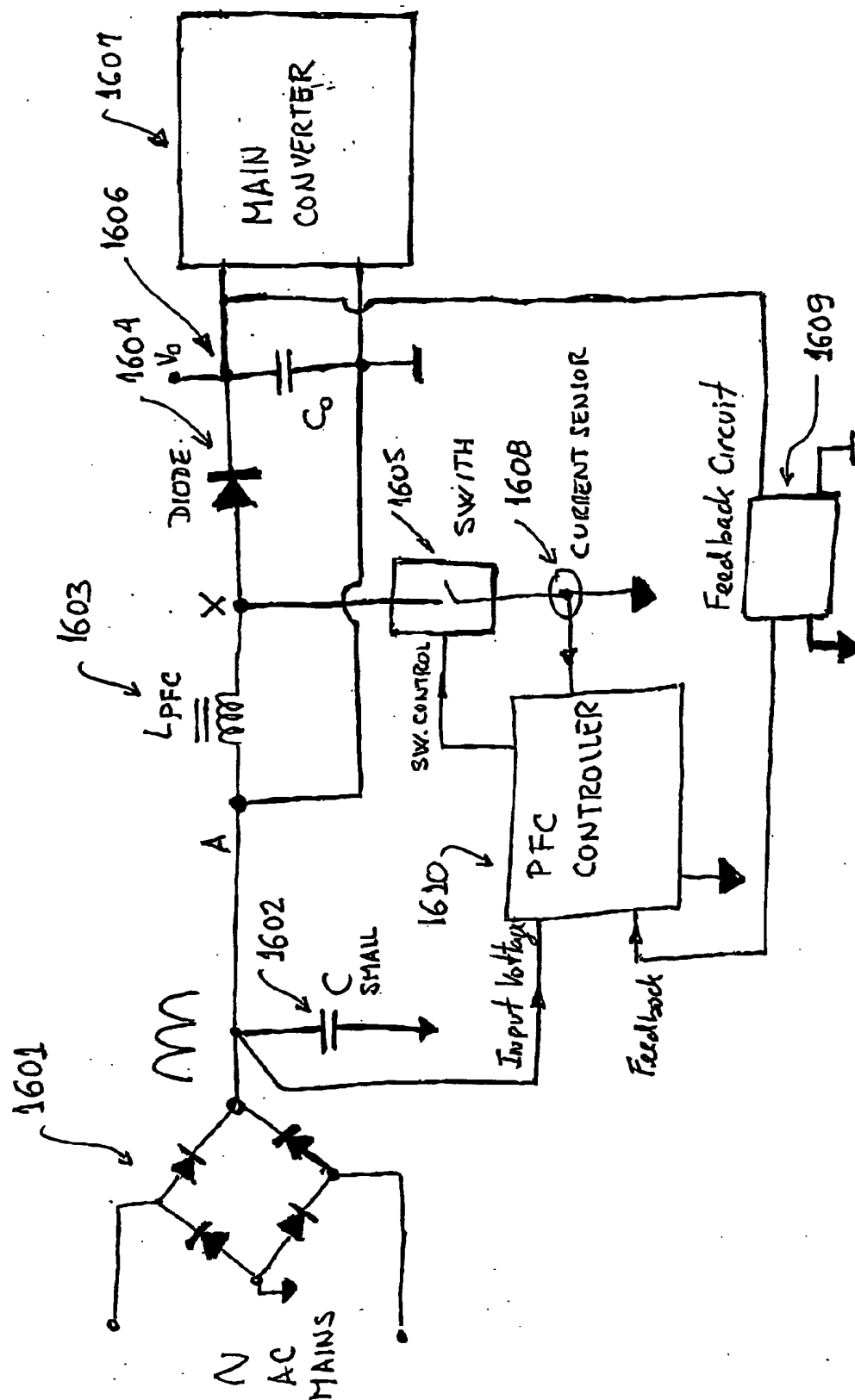$$(1506) \quad \frac{T_{ON}}{T_{OFF}} = \frac{V_M}{V_I} \quad (\text{For continous conduction mode})$$
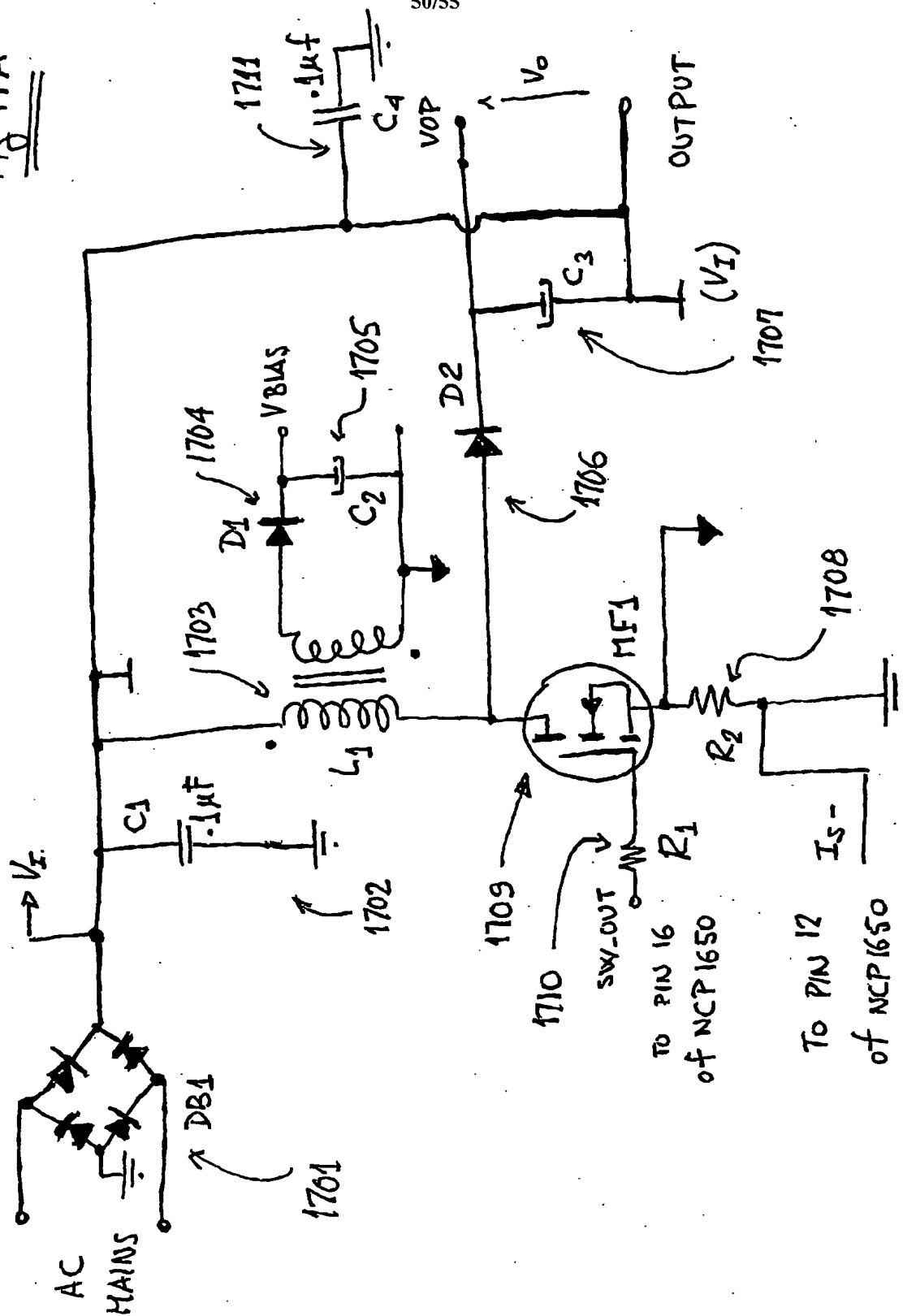
Fig 16

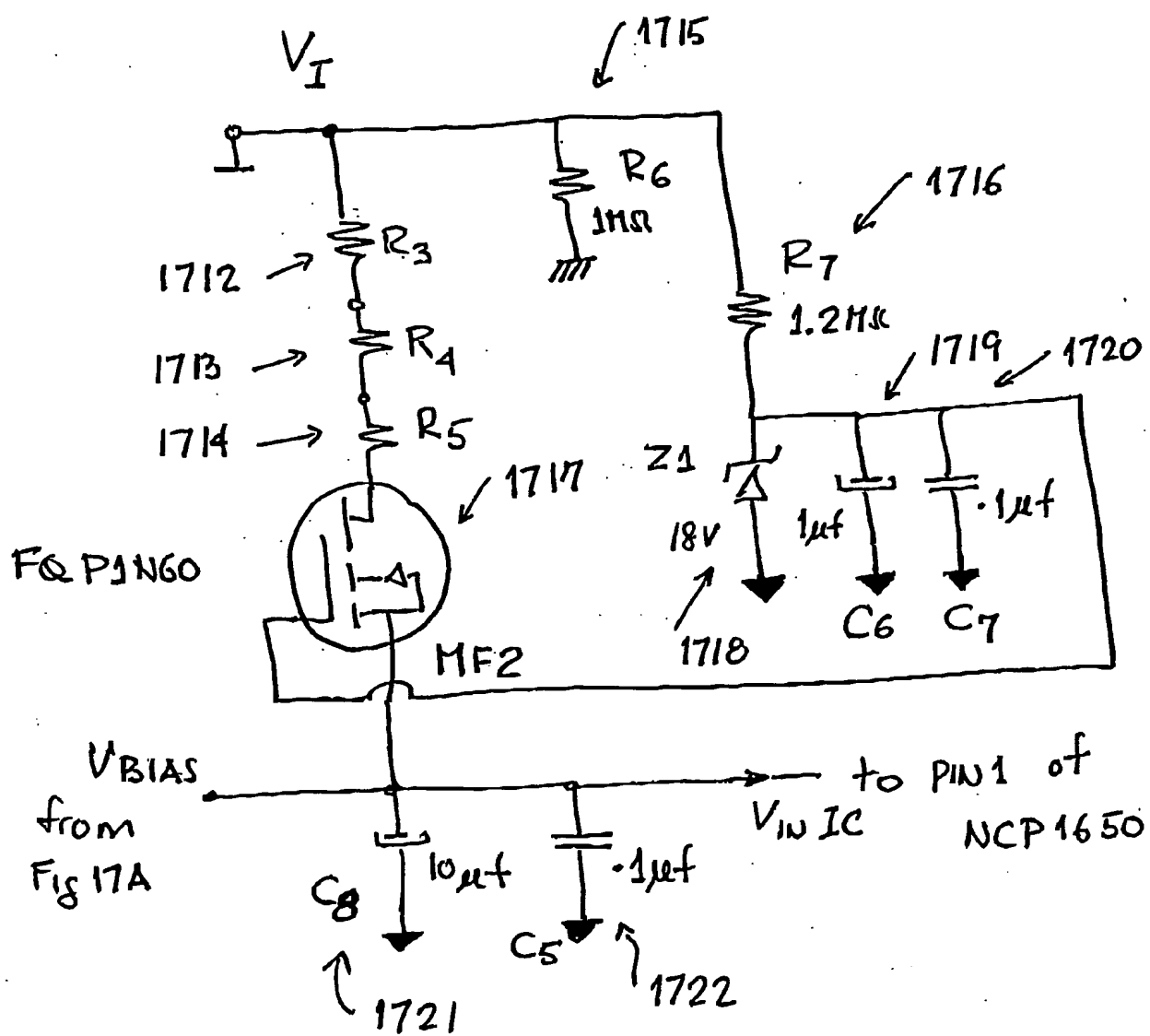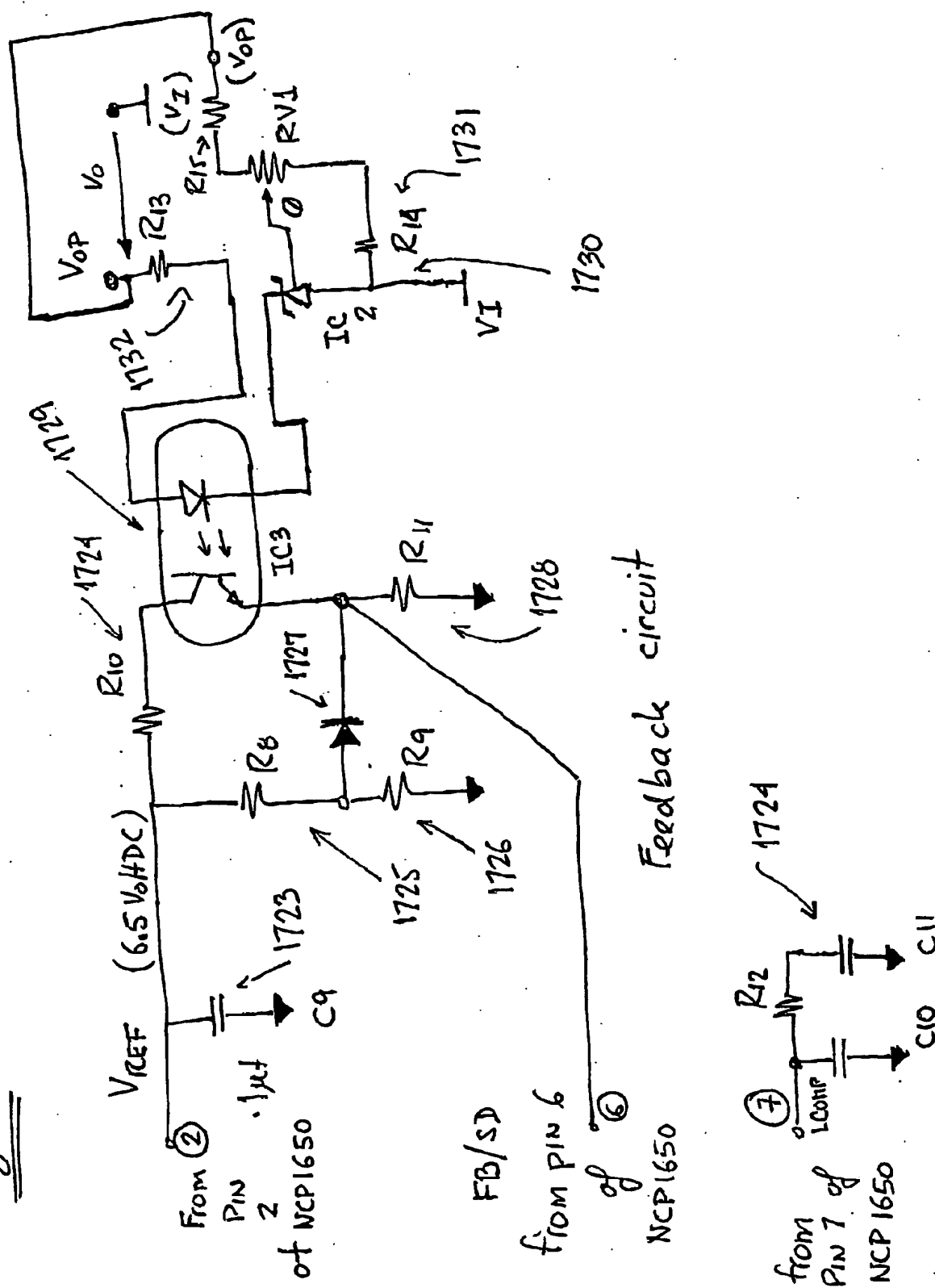MAIN CONVERTER 1606 1607

1604 V₀

DIODE

C₀ 1605

X

SWITH 1608 CURRENT SENIOR

L PFC 1603

SW. CONTROL

A

C SMALL 1602 1610

Input Voltage

PFC CONTROLLER

Feedback

Feedback Circuit 1609

1601

N AC MAINS

Fig 17A

Fig 17B

Fig 17C

Fig. 17D

Fig 17E
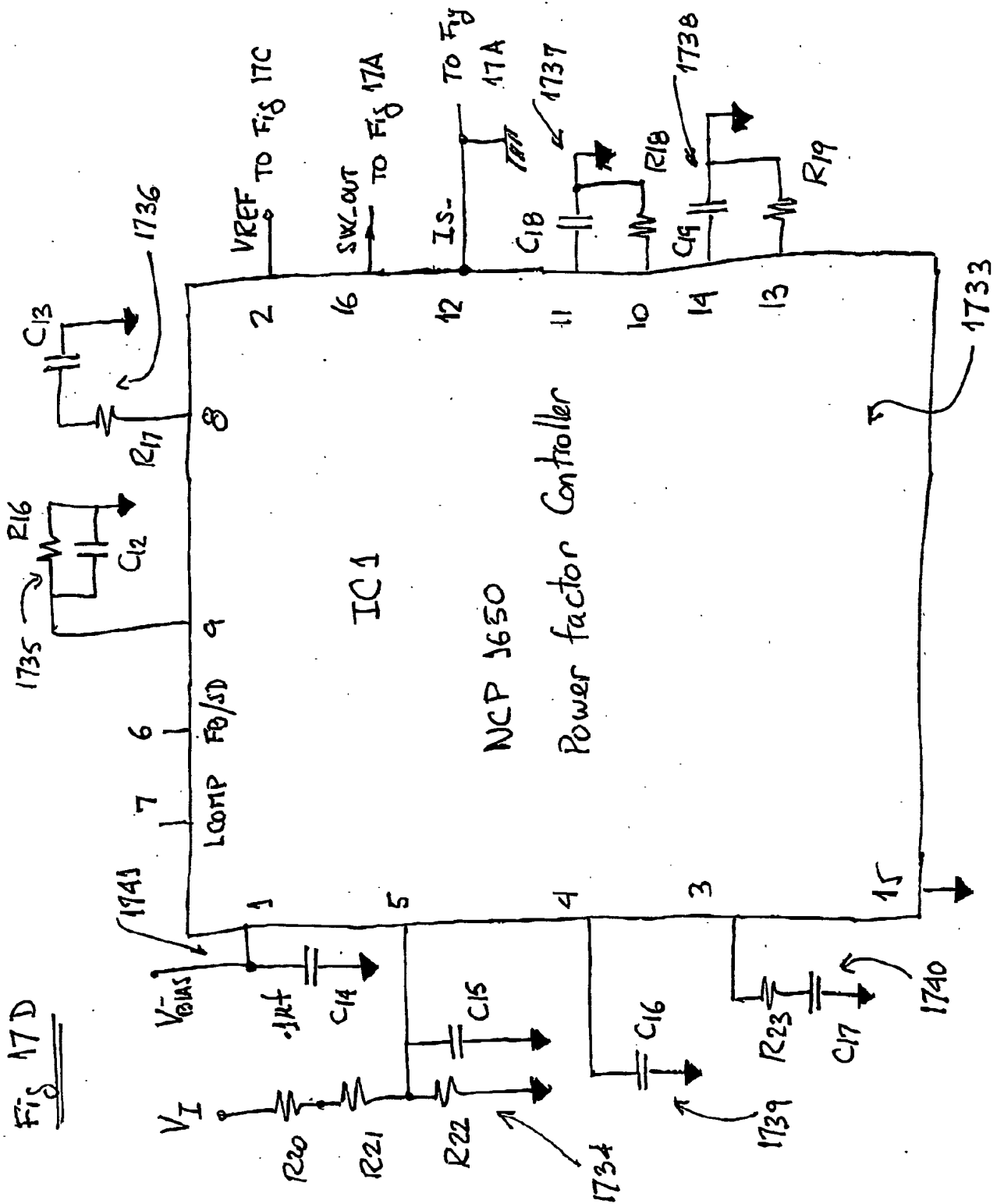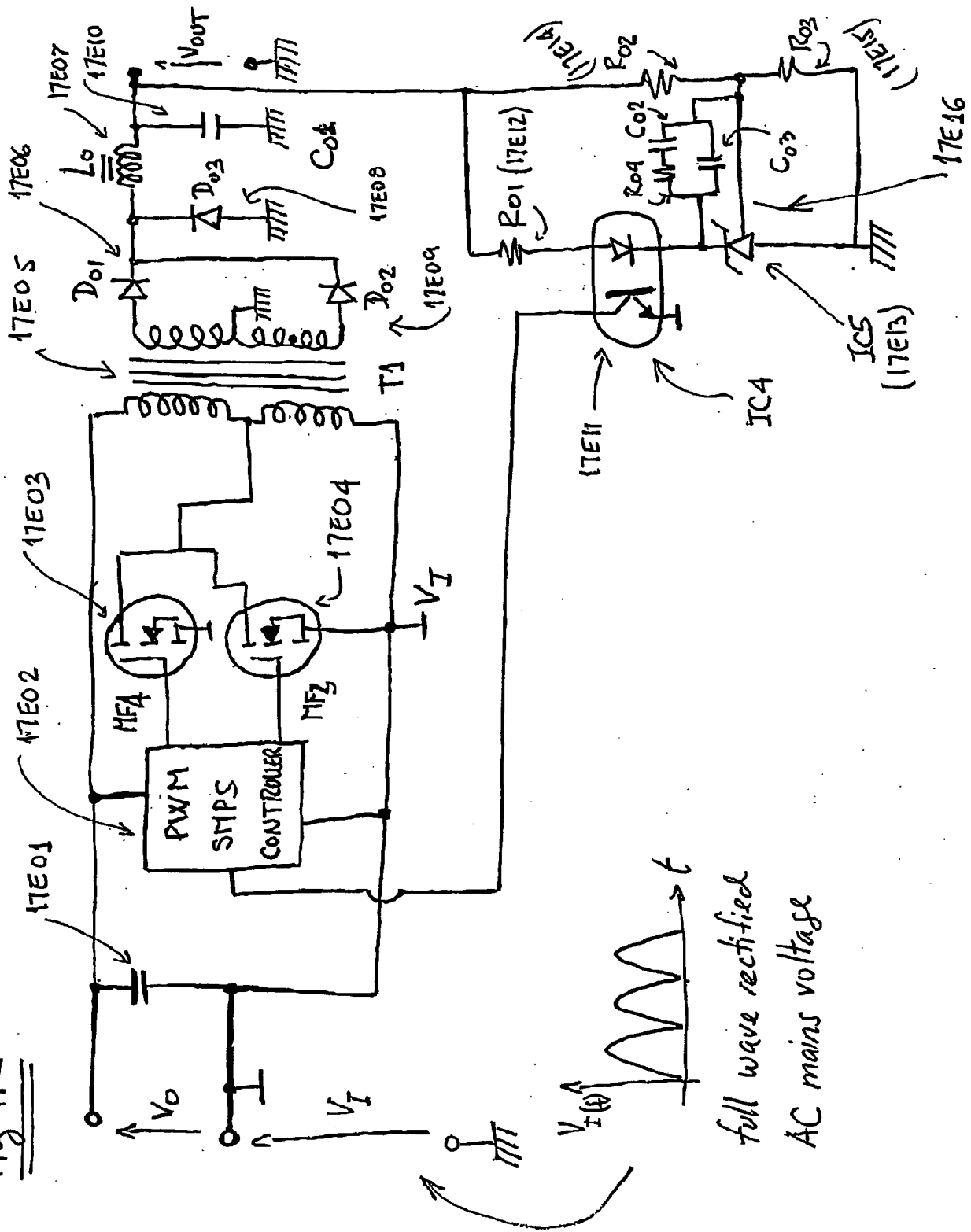
full wave rectified AC mains voltage

Fig 17F

Symbols for common terminal

↓ Common for NCP1650

⊥⊥⊥ Common for output of main converter (earth)

⊥ Common for input of main converter and PFC converter VI level

⊥ Common of bridge rectifier